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Digital Product Labels
and
The Mapping of Consumer Values

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ABSTRACT

Current labels of consumer products provide some level of information to consumers but at the moment, this expanding labelling logic, and the multitude of requirements it generates, is often tricky to implement and difficult to translate into a clear and accessible form of communication for consumers to engage with.

In the first part of the thesis, an analysis of current labels is carried out which examine a selection of widely used consumer products. This examination supports the objective to imagine the type of complementary information consumers may deem useful, and also highlights the difficulty there may be for consumers in accessing and verifying some key information that directly concerns the product they use and that may significantly influence the assessment they make of it.

To improve the quality of the information provided to the public, a four-tiered architecture is proposed in the second section that can respond to the issues that have been identified during the analysis and also with reference to techno-sociological considerations presented in the Literature Review. The end result is an online database which generates real-time digital labels that uses collaborative logics and allows users to conveniently explore essential information about the products and services they use and make decisions more in accordance with their own requirements and values. The system also offers

the possibility for the various label stakeholders to actively engage with the evolution of the product they manufacture, verify, legislate upon or consume depending on their relation to the product. In order to illustrate the potential of this architecture, the digital label is applied to informational situations commonly encountered by consumers. Conceptually, the digital label appears capable to meet consumer needs and is ready to be implemented into a prototype. The architecture is also considered against recent developments in terms of digital product labels, and appears to offer a solid foundation to catalogue, compare and analyse them critically.

The third section of the dissertation is a reflection on the merits of the digital labelling system, this time from a sociological perspective. The discussion has two objectives (1) validating the digital label as an information arrangement capable of responding to current societal demands and (2) determining the label underlying principles in order to guide further development.

Keywords: Information Quality, Consumer Labelling, Values, Verification, Context, Participation, Ethics, Product Design.

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INTRODUCTION

A SHORT HISTORY OF CONSUMER LABELS

Until a mere forty years ago, consumer products had very little labelling. Fruits and vegetables were sold in bulk and wrapped in plain brown paper bags, returnable glass bottles with concise branding messages and embossed deposit instructions shipped our favourite beverages, and skilfully adorned tins of metal preserved our favourite confectionery items. Only the most basic product descriptions were then presented to buyers.

And yet, the first labelling legislation, explains Robert J. Shiller (2010), Professor of Economics at Yale, can be retraced to a public outrage triggered by the publication in 1906 of a book, The Jungle, written by Upton Sinclair. The unsanitary conditions in the meatpacking industry described in the novel caused such a public outrage that the US Congress decided to enact the Pure Food and Drug Act that very same year. In 1910, Shiller notes, the "Jungle scare" had spread to the United Kingdom and labelling laws were established there as well.

Since then, regulations have constantly been adopted to meet consumers' greater demand for information. In 1979, it was the turn of the European Community to introduce regulations concerning food labelling with Directive

79/112 applicable this time within the European Market and which related, more precisely, to the labelling, presentation and advertising of foodstuffs. More recently, the new EU Regulation 1169/2011 on the provision of food information to consumers considerably changes existing legislation on food labelling and will apply from December 2014. In addition, the legislation covers the obligation to provide nutrition information applicable from December 2016.

As a consequence, an increasingly dense and descriptive label is composed which presents various domains of information. This information often relates to questions of content or processes, and can be as basic as weight description, list of ingredients or as difficult to verify as trading ethos (e.g. Fair Trade), potential health benefits, or again production methods (e.g. organic, GM free).

This labelling trend extends beyond the food industry to include an array of products and services where the experts and the legislator continuously acknowledge the necessity for consumers to be provided with a valuable context at the point of decision. This, for instance, would be the case with financial products and a key recommendation in a recent book compiled by a group of leading economists who reflected on the recent global financial crisis. "The Squam Lake Report: Fixing the Financial System" (French et al. 2010) suggests that investment products like mutual funds should include a standardised disclosure label analogous to the nutritional label on foods.

This trend can also be observed beyond the United States and the European Union, across various trading zones where distinct legislative cultures have contributed to a particularly disparate collection of labelling requirements.

From a sociological perspective, labelling the goods and services we consume could signal a wider reflection on the role of information with respect to questions of economics, social organisation and the management of global resources.

Problem Definition

But at the moment, this expanding labelling logic, and the multitude of requirements it generates, is often tricky to implement and difficult to translate into a clear and accessible form of communication for consumers to engage with. A host of studies has demonstrated weaknesses and tensions at different levels throughout this economically vital system of information: regulations have a long development period, may be subjected to pressures from the Industry, may be different from one trading zone to another, or the communication may be altered by questionable marketing practices, to list a few (e.g., Jacquet and Pauly 2008; Teisl et al. 2008; Mackey and Metz 2009; Steinemann et al. 2011).

These dysfunctions may be best understood when considering the highly sophisticated character of today's market place. Technological advances and intense globalisation play a major role in the production of an increasingly

elaborate stock of convenience goods whose dynamic context can be difficult to track and represent. The composition of information is often simply too complex, fragmented or opaque for consumers to assess its value conveniently and thoroughly.

Indeed, most of the food we now buy in supermarkets follows an elaborate path of production. The various ingredients found in a pre-packed Tesco chicken salad sandwich may have different country of origins and may have gone through very different methods of production some of which may be quite sophisticated. Considering their limited size, it would be unreasonable to expect current labels to provide a comprehensive account of these processes.

Again, the recent financial crisis offers food for thought and a good illustration of how detrimental to consumers, complexity and opacity can be. The failure on the part of the financial industry to disclose risks associated with some financial products and to acknowledge the limits of the complex algorithms and modelling techniques used to appraise these products have been for the last few years thoroughly documented. However, any critical accounts in these respects have remained by and large inaccessible to the general public and we may in fact wonder how would a label represent the subtleties of these accounts?

Moreover, how do we decide what topics should be covered by labels and how do we decide to which degree consumers should be familiar with any of these particular topics? When we buy cheap clothes in Primark, enticed by a powerful economic argument, it is easy to dissociate the act of purchase from a

BBC documentary (2008) which exposed the unethical use of child labour in some of the company's Indian factories producing the clothes - an obvious inconsistency with Primark publicised membership in the Ethical Trading Initiative. We can as easily dissociate ourselves from the intricate discussions, reports and courses of actions which followed this negative exposure and which raised questions about Primark's business practices. Although these exchanges are distant in time and space from the point of decision and purchase, they all pertain to the particular context of the clothes we buy at this prosperous high street retailer and awareness of these may significantly increase consumers' scope of decision and leverage to influence companies' working practice.

In these conditions, it is doubtful whether consumers, who can now shop across the world instantaneously with the advent of e-commerce, can be said to be well informed, or more problematic, in a position to take meaningful decisions. Manifestly, the sentiment that a good education and a good set of interpretative skills may no longer guarantee a good judgement is becoming increasingly evident.

Today's labels may not necessarily offer the information consumers need or want, and indeed, it would require a substantial amount of commitment and resources to gather the evidence required to perform more personalised and thorough forms of assessments. This approach would be impractical in everyday life where judgements are constantly being made.

For that reason, our choices for action are, instead, often based on inevitable strategies of trust often conditioned by effectual strategies of advertisement. At a time when communication has become a science whose applications may not necessarily be at the service of the public or the development of the common good, the rationale for both these approaches may be questionable and labelling legislations may prove insufficient.

The legitimacy of the prevailing economic model is based on the quality of the information consumers receive and emphasises freedom of choice. But it could easily be argued that there can be no real freedom of choice for consumers as long as the ideal of a well-informed citizenry is not attained.

Yesterday, the chief weakness in this prevailing model pointed to consumers' level of education, today's state of affairs points, in addition, to a new problem where, the notions of complexity, transparency of the information which belongs to the public domain, the management of public resources as well as new technological and cultural practises, must also be considered. This reflective exercise forces us to redefine what we mean by *quality of information* and more practically, determine how we can structure the information which clearly belongs to the public domain in order to reach a more sociologically consistent and qualitatively mature information system.

A Digital Touch

The digital era offers the possibility to rethink and develop alternative ways to communicate. The malleable nature of the Internet constantly demonstrates a potential to organise information more efficiently, more creatively and in a way that could better reflect democratic sociological demands. Much is being discussed in the literature about the prospect of citizens becoming empowered through the digital revolution. There is a clear desire to elucidate this potential and a host of research projects to that end.

For the past few years, several digital initiatives have emerged on the web confirming the interest there is to utilise the digital format of communication in order to provide consumers more information about the products they use. This complement of information can today be accessed in always more convenient ways. For instance, consumers can now search online databases or use applications installed on smart phones that can instantly identify an increasing amount of product barcodes to obtain information. This way, a digital alternative label can superimpose onto the physical label of a product, right at a critical point-of-decision.

Unlike what happens with physical labels, producers do not necessarily manage the information presented on this new generation of 'open' labels. This time, third parties whose vocation is to represent consumers' interest can be the ones who compile the information that describes products consumers use.

This change of ownership in who organises the information provided to consumers, signals a notable shift of power relation among label stakeholders who are potentially playing an active role in the assessment of and evolution of consumer products. In the following, four major communities of stakeholders are identified for convenience: *consumers*, *producers*, *experts* and *regulators*. Until recently, *producers* and *regulators* had a prominent role as information providers. Within the digital model of communication, *consumers* and *experts* are gaining greater visibility, while *producers* and *regulators* are becoming more accountable. But interactions among those various groups would need to be harmonised if more valid forms of democratic empowerment are to materialise.

However, at this point in time, there does not seem to be an overall conceptual strategy against which these digital attempts to create a more informative and balanced informational environment for consumers can be set against.

HYPOTHESIS

Within this new technological context, the thesis of this dissertation is that it is possible and desirable to elaborate an overall conceptual strategy that can drive the development of a digital platform where consumers can obtain all the information they need to assess the product they are interested in and where they can take decisions more in accordance with their own values.

AIM & OBJECTIVES

The aim of this research is primarily to understand and improve the conditions of our relationship with information in critical areas of the public sphere by considering the forces that influence the treatment of information in those situations and the potential that new communication technologies offer to organise information in more effective ways. Specifically, this study seeks to propose a valid conceptual framework that could better support the development of digital public information systems, in the critical case of consumer products.

Three objectives have been set to better envisage the nature of this conceptual framework.

- The first objective will concentrate on identifying possible sociological and practical requirements that consumers may have when using public information systems.
- The second objective is to develop an information architecture that can respond to these sociological and practical requirements.
- The final objective is a theoretical justification of the proposed information architecture from a wider sociological perspective.

THESIS STRUCTURE.

To attain the above-mentioned objectives the thesis adopts the following structure.

The Literature Review is divided into two sections and provides a broad perspective on questions of information arrangement from the angle of product labelling and also with attention given to current digital initiatives that have emerged to better inform consumers. Some of the socio-technological references upon which this research is based are then introduced in a second part. This latter part meets partially the first objective of the thesis by providing valuable notions that will be useful in the elaboration of the architecture. However, references to the literature also occur at various points in this thesis whenever needed to support specific arguments. This is especially the case for Part II and Part III.

The next section presents the methodology. There, the creative character of the research accounts for the method employed to evaluate the thesis as well as for the fact that a more intuitive approach was preferred to fulfil the aim of the study.

The body of the thesis starts from a concrete approach and progressively evolve to a more abstract one. More precisely, Part I (Analysis of Current Labels) presents an analysis of current issues with one of today's key information systems: the labelling of widely used consumer products. This section completes

the first objective by supporting the identification of consumers' practical requirements. In Part II (Architectural Elaboration), this analysis is used to support the development of a digital labelling system that is based on four key mechanisms. The Results and Discussion section discusses the merits of this architecture. Part III (Sociological Considerations) discusses the validity of this architecture from a sociological perspective with respect, also, to some technological considerations. Parts II and part III fulfil respectively the second and third objectives.

In essence, this thesis can be regarded as a preliminary study for a potentially more extensive program of research where both practical applications (digital consumer label prototype) and theoretical considerations (a definition of Information quality which focuses on the design of consumer products and the mapping of consumer values as well as the economic impact of an information arrangement of the kind suggested here) are further elaborated. The section on Future Prospects indicates possible avenues for progress along these lines.

LITERATURE REVIEW

One of the difficulties associated with the research presented in this study is that very little has been published in the academic literature on the topic of electronic labels. In particular, at the moment, there appears to be no scholarly articles at all addressing directly the development of a digital public information architecture as envisaged in this study. At the same time, the type of information arrangement that is under consideration falls under the purview of many different disciplines, which it would be laborious to review outside of the specific context in which each is relevant.

In particular, the manner in which the notions of *consumer labels, information quality,* and *public sphere* are associated to produce a profitable research angle is not straightforward to consider out of context. This review is composed of two parts, which respectively survey the practical situation of *the labelling of consumer products* and the more abstract notion of *digital communication.* More specifically, the first part deals with the state of knowledge regarding the labelling of consumer products. Current digital product label initiatives dedicated to better inform consumers are also briefly reviewed. The conclusion reached at the end of this first part of the Literature Review is that there is a lack of knowledge about how to design an optimal conceptual framework that can drive the development of key public information systems. The second part of the Literature Review explores a number of technological and

sociological references that can be considered in the development of such a conceptual framework. The ideas presented cover the nature of our technological environment, the sort of potential it offers, and also the questions it raises with relation to a digital model of communication for a well-informed citizenry. In light of this Literature Review, the research posture is further outlined in terms of its possible contribution to the body of knowledge. References to the literature also occur at various points in this thesis whenever needed to support specific arguments.

Labelling

State of Knowledge

When one surveys the literature dealing with product labels, a feature that comes out clearly is the fact that there is a wide diversity of meanings associated with the word "label" as well as a diversity of levels at which the term is considered. Some writings in the scholarly literature or web documents meant for the general public refer to labels in the context of certification, others envisage it, e.g., from the perspective of branding or the types of information that the manufacturer wants to convey about the product. When the words 'digital' and

'label' are connected, one finds, among others, links to business initiatives where digital technologies are used by the industry to gain a competitive advantage, increase sales and brand awareness. In the following, this bibliographical review will concentrate on the type of information labels can provide that satisfies consumers, and other purposes pursued via labels, such as branding, will not be discussed.

The information needs of consumers, and ways to satisfy them, can be approached from a number of perspectives. A key one, given the commercial nature of consumer products, is of course economic. In this context, the quality of information available to consumers is a critical aspect of the theory of market economy. Indeed, informational imperfection leads to imperfect markets and many scholars in academia or working for governments have commented upon this deficiency (e.g., Bonroy and Constantatos 2008; Golan et al. 2001). Some economists have also worked on remedial propositions to address this issue. For instance, Maynes (1976) suggested an optimum model, called the "Perfect Information Frontier", for consumers to be able to make better decisions. In this model, still in use in a number of current studies, quality is specified in terms of subjective and objective product attribute, measured, and graphed with relation to price in order to determine the optimum choice for any particular consumer. For economists, price and product attributes are often the mathematical focus of attention and how information quality is understood.

A second economic aspect that is occasionally discussed in the literature is the cost of processing information to satisfy consumers' needs. The types of

information consumers are interested in may be very different from one person to another. Due to the limitation of space on the label, choices have to be made that rely on market studies to evaluate the most significant pieces of information manufacturers or producers should provide. Because marketplaces are dynamic, these studies need to be constantly updated and an adjustment request of the label by the regulator typically involves operational costs associated with verifying the information and administrating the policy change. The cost and benefit analysis of this information processing often leads to the assumption in economic theory that voluntary labelling scheme instigated by the industry are a more viable course of action.

However, envisaging things entirely in economic terms, and leaving matters for market forces to handle, may not be appropriate when the type of information being considered is of societal significance. In such cases, the regulator is likely to intervene and to use labelling as a policy tool for the provision of health-related or environmental information deemed critical to address a particular issue. An example of this is the nutritional information on product labels. Due to an epidemic of health issues in various parts of Europe, Australia and North America, governments and health experts in these regions have been keen to alter consumers' behaviour in order to encourage healthier eating habits and reduce the burden of chronic diseases on society (Mello, Studdert and Brennan 2006).

In European Countries, studies have reported on consumers' perception, understanding and use of this category of information in particular by evaluating

the effectiveness of various front-of-pack labels. A multitude of formats have been suggested and reviewed. These include Guideline Daily Amounts (GDA) scores, Daily Intake Guide (DIG), traffic light, calory flags, smileys, stars, healthier choice ticks, etc.

When it comes to interpretation, some studies conclude that simpler formats are more effective and preferred by consumers (Rudd 2009), while other studies conclude that simpler can be misleading (Scott and Worsley 1994). Some suggested that the harmonisation of front-of-pack labels across products and across European countries would offer a more coherent informational landscape that could help consumers better interpret nutrition information (Feunekes et al. 2007).

However, harmonisation is difficult to achieve. A European regulation put in place at the end of 2011 ruled that nutritional information must be available on labels. But at the moment, concrete initiatives are still decided at the national level. In the UK for instance, the government has recently announced the introduction of a more "consistent labelling system" (Triggle 2012). The exact format and design of the labels in question is still under consideration. The current position is based on a Food Standards Agency study and supports a hybrid system that includes both the GDA scores favoured by consumers who prefer to have more information, as well as the traffic light colour code also favoured by consumers for the possibility it offers to communicate key information at a glance. The adoption of the design will be voluntary, as no

agreement has been reached between the various countries of the Union that could translate into a mandatory measure.

In Australia, the introduction of an easy-to-understand food labelling system - in this case the multiple traffic lights front-of-pack (MTLFoP) labelling system - was a key recommendation of the Blewett review (2011). This comprehensive study of food labelling law and policy was commissioned by the Australian Government. However, due to a lack of consensus between those who support the recommendation and essentially the industry, this recommendation has been put on hold. At the heart of the dispute is the validity and interpretive efficacy of the MTLFoP. More surprisingly, the government has ruled out recently the possibility of traffic food labels in favour of a non-interpretative very basic format the star system that rates the overall healthiness of a product (Chapman 2012).

Another type of information about which consumers may have an interest in knowing more is related to the country of origin of the goods they contemplate purchasing. There is a significant lack of uniformity in this respect, some producers putting as country of origin the last country in the production chain, for example where the products are packaged, whereas other producers or manufacturers list on the label the country where either the initial or a key step in the production occurred. The reasons that consumers may want to know more precisely the geographical origin of goods they acquire can be multiple. In some cases, it can be because they are conscious of energy costs incurred when transporting the consumer products across the globe, and for that reason may want to favour products that are local. In other cases, the reason may be political,

as when consumers actively boycott products from countries whose government's policies they object to.

Aside from economical, nutritional, or geographical aspects of products, an important set of considerations related to social, and in particular, social equity aspects of these goods or services. Survey show that socially-conscious consumers represent an increasingly significant portion of the consumer market. A Nielsen study (2012) carried out at the global level found that 46% of the population surveyed was prepared to pay more for goods produced in a sustainable manner. Finding ways to communicate this category of information is being intensively discussed in the literature. Theories such as the so-called "Value-based labelling" (e.g., Barnham 2002) have emerged to support the communication to consumer of the qualitative and process attribute of a product. Eco-labelling of, e.g., "sustainable", "organic", or "GMO-free" products involves ethical dimensions together with a technological component that requires scientific assessment. The labelling of consumer biotechnological products and in particular of Genetically Modified (GM) foods has been widely discussed in scholarly articles for the last two decades. In the absence of specific regulations, voluntary GM labelling is not providing discerning consumers with the choice intended (Botha and Viljoen 2009). Thus, unregulated GM labelling is not a viable alternative to a regulated approach in terms of consumer protection.

In this respect, the recent, surprising testbed vote in California – Proposition 37, which, had it passed, would have forced the labelling of GM products on the basis that consumers have a right to know what is in their food -

is remarkable. The biotech industry has a clear vested interest (more than 80% of corn and soybeans have altered genes) and reportedly spent over 45 million dollars in advertisements and pamphlets against this proposition, arguing that the price of food would go up and that decades of scientific evidence support the safety of GM crops and their derivatives. The fact that this last point is still largely debated, and that many countries are banning GM crops because of it, was entirely hidden from consumers in all the media campaign launched by the biotech industry, which eventually prevailed (proposition 37, astoundingly, was voted down).

This example of GM crops, fortunately, is not the rule. In some cases, because of a producer's corporate culture, attitude towards labelling may be more genuine and compatible with consumers' interests. In some cases, producers show a keen interest in understanding what standards matter for consumers and they adapt their business model accordingly (Howard and Allen 2006).

A last segment of the academic and trade literature referring to labels deals with psychological aspects of consumers' behaviour. A sizeable body of work has studied different types of response of consumers to the information presented on labels, for example via eye tracking or by subjecting consumers to non-standard forms of label design, and by analyzing the subsequent response of consumers and their purchasing patterns (e.g., Kelinmuntz and Schkade 1993 and 1994). This type of research, however, presents significant challenges in terms of conceptualisation and methodologies employed to assess consumers'

perception of product labels (e.g., Hieke and Taylor 2009; Grunert, Bolton and Raats 2011). Some studies have for instance pointed out the artificial character of the settings used to conduct assessments (e.g., online surveys), which may be very different from a real-life situation in a shop where various kinds of stimuli can affect consumer's assessment of a product label. Some reviews acknowledge that the various methodologies adopted to study labelling offer some insights into consumer's behaviour but may not be able to capture the multitude of wider cognitive and cultural dimensions at work when consumer consult - or do not consult - labels. The complexity of the phenomena may account for the current lack of solid conceptualisation in this area, and as a consequence, it may explain the difficulty experienced by researchers to design studies that can offer a more wholesome and useful understanding of labels. At this point, the research community (Cowburn and Stockley 2004), and the regulator admit the limitations of the current state of knowledge as illustrated for instance by the US Food and Drug Administration's (FDA) 2010 request for further consumer research on nutrition symbols appearing on the front of food products.

A clear conclusion of this rapid overview of some of the issues associated with product labels is that there are many different types of information that consumers may potentially have an interest in, dealing with socio-economic, health-related, ethical, sustainability, and geographical considerations, among others. Each of these dimensions of the information associated with products is clearly linked to one or more constituencies, which may have economic reasons,

if nothing else, to exert pressure on the way labels are formulated, and on the information they provide to consumers. At the same time, consumers differ widely in their response to specific types of information and to label designs.

These observations lead naturally to the conclusion that the development of standardised labels for products, which would satisfy the demands of the producers and at the same time provide all consumers the information they desire, is pretty much a utopia given the current format of product labels. Printed labels, as we know them now and in particular as physically limited as they are, just cannot satisfy everyone, and they cannot provide consumers with a reliable informational landscape and interface for consumers to interpret. Research often frames in terms of physical space the whole question of the information that labels can display. However, any focus on the limitation of space that characterises physical labels (e.g., Wansink et al. 2004) distracts from the potential that lies with organising information in different ways. Therefore, the logical next step in the analysis is to enquire how the digital model of communication is affecting labelling. Many articles deal with the quality of health information online, but unfortunately the academic literature is very scanty when it comes to the digital labelling of widely-used consumer products. The digital model has yet to be reviewed at all in the literature. What progress has been made in the area has been largely outside of the academy, mostly achieved by private companies or organisations, occasionally even non-profit ones, who are attempting to exploit the mobile technology to provide information at the critical point of decision. Within the digital model of communication, the most significant

constraint, that of space, can be entirely alleviated and can be thought from a dynamic perspective, under the control of the consumers. Digital labels can provide information instantaneously at the critical point of decision.

A Digital Touch

For the past few years, several digital product label initiatives have emerged confirming the interest there is to use the digital model of communication to provide more information to consumers. Many of these initiatives take advantage of mobile technology to bring information close to the point-of-purchase by scanning barcodes and retrieving information that can superimpose onto the producer's label (Fig. 1). This complement of information is compiled in different ways according to different business logics.

Figure 1 - Illustration of current digital labels.

For instance, labels may focus on one specific ethical aspect, or they may focus on several and more general ones, some will give convenient access to the verification data, others will not. They may be managed by a private company, a not-for-profit organisation, or an independent group. They may or may not cultivate close ties with the industry.

The next section reviews some of these alternative labels (all of which have been last accessed on 12 December 2012).

Free2Work - [URL: http://www.free2work.org/]

provides consumers with information on how a products relate to modern-day forms of slavery, with information about the likelihood that products are made with forced or child labour. This program initiated by a US Non-Profit Corporation (rather than an organisation) and supported by the *International Labor Rights* Forum bases its evaluation on public research and data reported by the brands themselves. According to the specific risks associated to the supply chain of a brand, companies' efforts are assessed in terms of policies, monitoring, transparency, and worker rights and subsequently graded. Mediates communication between consumers and companies. Co-opted forms of regulation, works closely with the industry and they advertise that their system follows a principled method of assessment the specifics of which are not available.

Eco-Labels – [URL: http://www.greenerchoices.org/eco-labels/]

is a digital label provided by greenerchoice.org and a web-based initiative launched by Consumers Union, the non-profit publisher of the popular American monthly magazine, Consumer Reports established in 1936. Its contribution focuses on the evaluation of environmental-friendly products and practices. More specifically, it provides reports on the multitude of certifying labels that are used to promote green products. These reports evaluate in what way each certifying label is meaningful or not. Eco-label can be downloaded as an application but

does not provide any other information than a description of the certification labels. Consumers can obtain more in-depth reviews and in-house testing results of widely used products by subscribing to the Magazine.

Open Label - [URL: http://theopenlabel.com/**]**

is a smart phone application that uses social media logic, to provide information to consumers. Its model is inspired allows consumers to exchange reasons to buy or avoid products. Once a person scans the bar code, they will see "a bunch of comments in various categories (animal rights, environments, health and safety)." Users can even vote comments up or down, report comments that "you feel it shouldn't be there," and follow other users or organizations they trust.

Good Guide project – [URL: http://www.goodguide.com/]

offers a more comprehensive information arrangement. This private venture earns revenue from companies that purchase advertising and business intelligence with the intent to stimulate the production and diffusion of more sustainable consumer-centred products. It provides tools that can enable consumers to make purchasing decisions on the basis of the health, environmental and social impact of a product's life cycle. Experts from different fields evaluate hundreds of criteria using scientific standards of practice and informatics systems that have been developed by scientific, regulatory or other authorities. The methodology used to organise and transform high-quality data into actionable information for consumers is particularly thorough. For each issue

being assessed, a set of indicators is identified; to cite a few, transparency indicators are used to measure the relative amount of information available from a company for assessing its environmental or social performance. At the product level, data adequacy indicators track whether the specific data elements that are needed to assess a product's health or environmental impact are public.

These products are designed to provide consumers with information right at the point of sale, to help them conveniently apply their values to their purchases.

Another organisation, whose vocation is to empower consumers with information but does not use barcode technology to produce a digital label, is the Environmental Working Group (EWG).

EWG – [URL: http://www.goodguide.com/]

This non-profit organisation has two main objectives. The first one is to provide consumers information about the wide array of toxic products and contaminants contained in popular consumer products. Their largest database 'Skindeep' offers a constantly updated assessment of cosmetic products. Each are attributed a hazard score that reflects known and suspected hazards of ingredients used in the product and a data score that reflects the availability of studies available in the open scientific literature in order to determine whether the score is established on a comprehensive set of solid data or a near absence of data. Both these ratings are colour-coded for ease of interpretation. However, the detail of the assessment itself is not accessible only a brief methodology

section outlines the format followed to conduct the evaluation. Another goal the organization has set itself is lobbying for national policy change. They offer the consumers they inform the possibility to take concrete and effective action in very convenient ways through for instance online petitioning.

In conclusion, through these various digital label initiatives, a much richer information on products is available to consumers than is the case with traditional physical labels, which are unavoidably limited in their physical space. Digital labels currently available demonstrate partially the potential the technology affords customers to become more aware of their choices when making decisions and also to take action whenever indicated. However, these efforts are still scattered in the sense that the labels call on very different sources for their information, and use very different methodologies. In addition, from a consumer perspective, there is at the moment no comprehensive understanding of the products' merits and demerits. Under these conditions, it is perfectly conceivable that a product scores well in one system and poorly in another system. In terms of the relevant academic literature, there is at the moment a total absence of scholarly work on how these various digital labels initiatives compare. There is also a complete lack of fundamental knowledge about how to design an (optimal) conceptual framework that can drive the development of a more comprehensive and coherent labelling system and tap into the potential offered by the digital model of communication.

Digital Communication

This third part reviews the nature of our digital informational environment, the sort of potential it offers, and also the questions it raises with regards to a well-informed citizenry.

There are, in particular, two aspects worth noting in this exceptional revolution: how we can now access information and how we represent information.

In terms of access, information has never been that present and that instantaneous. Developments in terms of hardware and software converge to offer a growing portion of the population access to information at a remarkable rate and in an unprecedented manner. There are no reasons to believe that this trend will reverse at any time in the foreseeable future.

Also, access takes an entirely new meaning in the digital era, substantially stimulated by the fact that producing and distributing work is no longer constrained by the same sets of restrictions. Based on this observation, Yochai Benkler persuasively demonstrates in the Wealth of Networks (2006) the democratic potential of the net as a platform for People Power. Informed with references from various disciplines ranging from political philosophy to network topology, he skilfully distinguishes between the industrial stage and the digital stage of the information economy. In the latter, he notes, production is shifting from physical products to decentralised information goods whereby passive

users have the possibility to become active participants. This is realised through what he refers to as the 'commons-based peer production' model, a model motivated by incentives others than the purely monetary or proprietary ones, which the established model had until now favoured. Nonetheless, this redefinition of information ownership presents a whole new framework of opportunities along with some serious challenges. Benkler concludes that the decisions we make today to adjust our legal framework will greatly impact our individual liberties and our relation to the creation process.

Kevin Kelly (2007), editor of the American magazine Wired, also provides valuable touchstones to continue a reflection on the social impact of this technological revolution. He reminds us of the exceptional abundance of information now available to us through the Web, an unthinkable prospect only a couple of decades ago, and invites us to open our mind to future possibilities. He suggests that all the connections we establish at an exponential rate through our computers, handheld devices, servers, etc,..., lead to the constitution of one global machine, the Web. Within this model, every screen-fitted device with an online connection can be considered as a portal or a window which is looking into that one machine. Our data will be Web-based, and all the objects we interact with will be linked to the Web in one way or another. There are already clear signs of the 'ubiquitous computing' era with the rapid development and convergence of technologies like Radio Frequency Identification (RFID) for instance, where smart labels track and connect to a network an increasing number of consumer products (Catarinucci et al 2011) or "Augmented Reality",

where information through the means of advanced mobile interfaces can be conveniently superimposed onto our direct physical environment (Yew et al. 2011). Everything will be connected and "The Web will own every bit". Thus, Kelly concludes that the new economy will be based on a union between the digital and the atomic, a union where the information and the digital nature of things becomes embedded in the material world.

This particularly reliable machine, he also remarks, which has run uninterruptedly ever since its inception at the beginning of the 1990s, will in terms of processing power, surpass the total processing power of humanity by the year 2045 according to current predictions. This analysis is reminiscent of ideas presented by intellectuals, such as Kurzweil (2005), and emphasises a view of the future where strong artificial intelligence (i.e., an intelligence that matches or surpasses human intelligence) plays a major role and where the metaphor of the Web evolving as a conscious brain emerges mathematically. This new paradigm where our relationship to information is fundamentally redesigned is highly prized by a dynamic high-tech entrepreneurial culture. Top corporate players from initially Silicon Valley like Google but also increasingly, players from all over the world, are eager to take part in this singular[1] moment and make their mark.

But unlike what is often suggested, it may not be the processing capabilities of computers that are at the heart of this astonishing revolution, but their logical malleability. A logic which, suggests Professor James H Moor

[1] 'Singular' here is a reference to the name given to the year 2045, i.e. 'the year of singularity'.

(1985), can be shaped in endless ways, and this is precisely what makes computers "the nearest thing we have to a universal tool". Furthermore this logical malleability confers a semantic dimension to this technology. What we manipulate are symbols, and this is why many, rather than single, applications and interpretations are possible.

This insight into the fundamental nature of computers allows Moor to depart from an essentially numerical analysis such as the one proposed by Kurzweil (1999), to give more weight to the human factor and to the influence of culture in all its aspects. The focus on the metaphor of the one brain waiting to be made conscious "by the complete set of unifying formulas that underlies intelligence" may reduce the possibility of engaging with these particular cultural dynamics. This approach makes it difficult to envisage the role of each individual versus the part played by computers or the manner in which issues of a cultural nature would be resolved within this panoptic mathematical consciousness. More practically, how will the conscious Web embed values? Which values? Whose values? What sensibility of language will be used to represent the digital nature of things, and label the atomic world? Will this language be common to us all? Moor situates convincingly that the driving question of the Computer Revolution therefore ought to be "how can we mold the logic of computers to better serve our purposes?"

These considerations bring to the fore one critical challenge. This challenge is, in essence, of a qualitative nature and, for that reason, more delicate to engage with: the mapping of our values. How can we structure our

rapport with information to support this sociological demand? How will this translate within the fabric of the Internet?

This question is at the heart of this dissertation, and it may be useful to become more acquainted with some architectural considerations before it can be approached. The Web, as indicated earlier, is already a major vehicle for our sociological demands and the gradual restructuring of our relationship to information. Its architecture has considerably evolved over the last couple of decades from 'Web 1.0' to Web 2.0 and now, towards 'Web 3.0'.

Web 1.0 described an architecture that consisted essentially of linking computers with one another. This was the time when users had to go through FTP sites to download static documents. Web 2.0 saw the rise of user-generated content with more interactive applications and an architecture focused, this time, on links between pages. The third stage of this evolution, and what is nowadays often referred to as the Semantic Web or the Web of Data, has been described in various ways. It has also become a focal point for some of the most esteemed thinkers of the Web, and, a comprehensive project for the World Wide Web Consortium (W3C), the main international organization to develop standards for the World Wide Web. It is still being actively researched in the midst of an effervescent period of Web-related technological advances.

The Semantic Web has a more intuitive slant to it and is based on linking data together. Within this configuration, the structuring principle is the meaning of the data and therefore the attention is no longer focused on our ability to best link

pages together, but the Web's ability as an intelligent agent, to identify meaning and link raw data together and to dynamically present them to users via a highly personalised interface. At present, this ambitious aim remains fraught with serious difficulties. 'Intelligence' may not be so easily and precisely described after all. Likewise, the symbolic nature of 'meaning' may not be so easily transcribed (Pape and Kok 2011). This may account for the great variety of research approaches constantly emerging within the semantic Web community and which extensively draws from advances in artificial intelligence. But unlike the field of artificial intelligence, the semantic Web, as an interface between data and users, is governed by an underlying commitment towards being useful to humans rather than simply striving to emulate humans.

Berners-Lee (2009), often credited for having invented the World Wide Web, asserts the potential significance of such an informational rearrangement for a well-informed citizenry. His latest project concentrates on developing semantic Web logics to make available government data to the general public (Berners-Lee 2009). In that sense, the Web of Data encourages the redefinition of information ownership evoked earlier and the sentiment that ideas of 'access' and 'representation' effectively converge to adopt a sociologically more profound meaning.

A key question in this creative enterprise is how the information should be structured to improve its quality and scope and, more practically speaking, how it should be organised so that anyone could obtain the information he/she needs to make more valuable searches, more valuable forms of assessments, and more

valuable contribution to the production of knowledge. Given this objective, the labelling of the material world and the understanding of how these descriptions could allow us to negotiate our values seem, suddenly, more strategically important.

The research described in this thesis is an attempt to answer these questions in a practical way by looking at a labelling activity at a scale we are familiar with: the labelling of consumer products.

METHODOLOGY

This research is at heart a creative exercise. The digital revolution is still in its infancy and we now need to elucidate the potential this malleable model of communication offers us. In addition, the Literature Review pointed to a lack of solid conceptualisation on what constitutes a good information infrastructure. The conceptual exploration into the digital medium proposed in this thesis calls for the use of more flexible methods of investigation, through which innovative propositions can eventually be engineered and hopefully reveal their societal pertinence.

This study was initially motivated by an intuition and is conducted as a design assignment. The assignment focuses on the development of a more wholesome, optimal informational environment for consumer-type users, considered in their more complete anthropological dimension. In addition, the elaboration of a conceptual framework is not a linear process. Rather, it is an iterative one between problem and solution, and between various levels of reasoning. In the case of this particular study, the iteration occurs between a fundamental interrogation into the nature of our relationship with information in the public sphere and a more focused assignment that examines the particular issue of product labelling.

Likewise, the interplay between the three main parts of the thesis - analysis, architecture, and considerations - contributes to crystallise important ideas. The architectural piece presented in the second part captures and organises those ideas, which both the Analysis and Considerations sections serve to nurture and adjust. More specifically, the Analysis identifies practical requirements while the Considerations section helps envisage the sociological pertinence of the informational arrangement being developed.

The Analysis Section:

The method employed in the Analysis section adopts a concrete case-study approach that can accommodate a more intuitive style to evaluate what consumers' needs may be. Case studies of popular consumer products are a common approach in the study of consumer labels as many of the references in the Literature Review They have allowed demonstrating and cataloguing a number of limitations with current labelling strategies. However, what is sought in this study is set beyond the awareness of the dysfunctional. Rather, the focus is attuned to the identification of requirements that could support the elaboration of an architectural project. For that reason, a certain latitude was preferred to a somewhat stifling systematic approach for the expression of analytical considerations.

Concretely, five consumer products are selected based on the fact that they are popular consumer products that can be easily acquired in major outlets

in the UK. Another key reason for their selection is the fact that those products present a particular attribute or a specific benefit (e.g., organic, fairtrade) that makes them uniquely attractive to consumers. Each product is then reviewed via a three-step evaluation that (1) considers the information available on the physical label attached to the product, (2) considers some of the information available online that relates to the product and (3) discusses the rationale followed to conduct the subsequent assessment of the selected product. The next chapter synthesises the relatively open-ended and unrestricted observations made during this three-step evaluation. Hopefully, essential notions can emerge during this process.

Also, at this early stage of conceptualisation, using the author's point of view as the sole reference to conduct the analysis appears justified. As a consumer but also as an intuitive and attentive observer, the researcher may be more receptive to possible ways to address the multi-faceted problem that has been outlined earlier. The merits of this single source of reflection and free-style approach is realised, once a model of architecture that proves theoretically tenable and pertinent can be proposed. This is the aim of this particular study.

Beyond this phase of development, more rigorous prototyping methodologies could be employed that open up to external criticisms, and allow quantitative and qualitative user surveys to produce a meaningful solution for consumers.

The Architectural Section:

As mentioned earlier, this section acts as a catalyst where analytical observations and sociological considerations can coalesce and be translated into an architectural model. A short text introduces this segment of the thesis. It sketches the background intuition and visual target that drive the elaboration of the architecture. The next step, termed Design Intention, situates the concepts used. The Overall System Description then offers an overarching summary of the architecture proposed. The architectural elaboration can then begin. High-level mechanisms and diagrams are the two outcomes of this architectural effort. Scenarios can then be used to test the coherence of the system, illustrate the key functions that can be derived from this informational arrangement, and visualise the sort of rapport that could be nurtured with information that belongs to the public sphere in a digital environment.

This Considerations Section:

The design of public information systems necessarily raises a number of important sociological questions. How we decide to arrange information that belongs to the public domain necessarily impinges upon questions of economy, of education, upon our rapport with knowledge, and also how we allow the definition of quality of information to evolve. For that reason, a more reflective space that runs in parallel and interacts with the analytical and architectural

efforts, harbours an examination of the societal implications of the architecture under consideration. This reflective exercise can also serve to nurture the 'evolutive' design process.

This three-tiered research method, which offers the possibility to simultaneously appreciate practical concerns (analysis), solution (architecture), and sociological pertinence of the solution (considerations), could also be employed beyond the Ph.D. to pursue the development of Public Information Systems.

Part I – Analysis of Current Labels

This section proposes an analysis of the manner in which the information relating to some widely used products is presented to consumers and may be verified by them. As mentioned earlier in the Introduction, a host of studies have already documented some serious deficits with today's labels. This examination supports the objective to imagine the type of complementary information consumers may deem useful, and also highlights the difficulty there may be for consumers in accessing and verifying some key information that directly concerns the product they use and that may significantly influence the assessment they make of it. The first chapter presents an analysis of some widely used consumer products. Chapter 2 synthesises the observations recorded from the analysis.

CHAPTER 1 - CASE STUDIES

METHOD

The first chapter presents an analysis of five products. In each case, a brief account of the information currently available at the point of purchase or decision is given. One aspect or more of the information made available at that point, or beyond that point, is then investigated using the Internet - an increasingly prevailing form of search amongst consumers. For instance, a label may emphasise a particular quality, say a health claim, of the product it is associated with. As a health-conscious consumer, how would I verify this claim? What sort of information would be accessible on the Internet on the subject? How would I engage with this search process? And finally, how would this process affect my assessment of the product? The idea here is to search for information generally available beyond the point of decision in order to attain a more informed position with regard to this particular aspect while recording the progression and the mechanism at work in the course of this search. The various accounts thus gathered for each case study are then synthesised in the second chapter in order to identify possible requirements consumers may have when consulting labels.

The creative character of the research accounts for the method employed to evaluate the thesis and the fact that an intuitive and free-style approach was preferred over a more quantitative and systematic one. The digital revolution is in

its early days and its potential still needs to be envisaged. Moreover, at this early conceptual stage of development, using my own assessment of current labelling systems and contrasting it with my own consumer requirements or idealised expectations in terms of informational environment appeared more appropriate and also more profitable. At a later stage, representative groups of consumers could participate to a more quantitative-oriented evaluation of a full-fledged prototype. A more complete explanation about the approach used to carry out the research can be found in the 'Method Section'.

The goods listed in the table below have been selected for this analysis on the basis that they are popular consumer products that can be easily acquired at high street retailers.

Case No	Name	Retailer Provider	Product Description
1	Fat Spread	Tesco	Flora Heart Age Original Vegetable Fat Spread
2	Milk	Lidl	Graham's Organic Semi-Skimmed Scottish Milk
3	Coffee	ASDA	Fair Trade Ethiopian Mocha Limu
4	Socks	Mark & Spencer	Mark & Spencer Freshfeet with Silver Technology
5	Wood	B&Q	Tanalised Deck Post Cap

Table 1 - List of products selected for analysis.

Each case study is structured as follows:

- **LABEL**: The information available at the point of purchase or decision is described.

- **SEARCH**: An online search of one or more particular aspects of the product being considered is carried out. Internet searches are not necessarily straightforward and will frequently follow an undefined course. For that reason, attempting to rigidly codify the search in terms of time, number of websites to be consulted, etc....seemed inadequate. In some cases, a few hours were spent on a label; in other cases, the information came through a longer period of time. Rather, the focus was on allowing spontaneity to emerge and collect qualitative observations without any particular a priori. Thus, only the primary search words are indicated together with a summary of some key points emerging from the search process. A list of the most relevant websites that were consulted during the search can be found in the Appendices section. The summary is given occasionally together with a brief account of the communication that took place with manufacturers or other participants such as suppliers. Again, the detail of this exchange is located in the Appendices.

- **PERSONAL ASSESSMENT**: This section records qualitative observations relating to the search activity and how it affected my assessment of the product. It starts with a reassessment of the product in the light of the

information found online as opposed to the one that was found on the label. Comments regarding the experience of searching for complementary information are then made along with remarks about what could be a richer informational environment for consumers.

CASE STUDY 1 – FAT SPREAD

This tub of vegetable fat spread was purchased in Tesco – a British international grocery and general merchandising retail chain and UK's largest supermarket chain. The product itself is manufactured by Unilever, an Anglo-Dutch multinational corporation that owns many of the world's consumer product brands in foods, beverages, cleaning agents and personal care products.

❖ LABEL

Figure 2 - Fat spread product label.

In this case, the information available at the point of decision is printed on the tub itself (Fig.2). Relative to the space available, there is a considerable amount of information pertaining to different domains that is being displayed for the attention of buyers. The size of the font makes it difficult to read. Within this layout, health claims have a favoured position and are conveyed through various means. These include the name of the product (Flora Heart Age), logos (Healthy Choice, International Dietary Guidelines & Flora and the World Heart Federation Logo) and short statements such as "Helps keep your Heart Age Young with Omega 3 & 6". Other types of information of a more factual character are also indicated, such as product weight, list of ingredients and a table detailing nutritional information. Finally, instructions on how to store and cook the product together with the manufacturer's contact details are inscribed on the back and sides of the tub.

❖ **SEARCH**

Search Focus: The most prominent feature on this particular label concerns health claims. However, from a consumer perspective, the value of these claims is mostly based on trust. The logos and in particular the one which associates the manufacturer to the World Heart Federation constitute the closest form of validation presented to buyers but it does not explain how standards in this respect have been established. Also, a rapid

examination of the ingredients and nutritional information marked on the tub is not sufficient to assume a well-informed position or validate these health claims inasmuch as the list of ingredients is incomplete and equivocal (e.g. percentages do not add up) while the nutritional table may require a certain amount of knowledge (on fats and health) to be fully appreciated.

In addition, news articles have for the last few years periodically pointed to health risks associated with the use of hydrogenated oils (also referred to as trans fats) in margarines (e.g., Lawrence 2010) and in a wide variety of food products. Clarifying what this process is, whether it has been used in the product I bought will be the starting point for an investigation which wider focus is to understand whether Flora Heart Age's health claim are valid.

Online Search: The primary search words string for this study was "flora hydrogenated oils health risk". Seven sites were given greater attention during the online search (see Appendix A for their URLs) and the following points emerged from consulting them:

- Hydrogenation is a process that allows adjusting the melting point of polyunsaturated fats thus affecting the consistency and texture of the product that contains these sorts of fats. It also prolongs these products' shelf life. . It has been extensively used in margarine and

vegetable fat spread. It is also being used in a wide variety of food products.

- The view promoted by the industry, some influential government agencies - including WHO -and some members of the scientific community is that polyunsaturated fats are healthier than saturated fat (found in butter). This perspective is not wholly supported by scientific evidence. In the early 70's, studies have shown links between the consumption of polyunsaturated fats and cancer .

- In 1993, Professor Walter Willett published evidence that trans fats - polyunsaturated fats resulting from the hydrogenation process - were damaging for the heart. Some polyunsaturated fat like Linoleic acid (Omega 6), is one of the essential fatty acids that our bodies need but cannot synthesize. We must eat some to survive but there are natural forms of linoleic acid that are beneficial like conjugated linoleic acid (CLA).

- Inversely, claims that saturated fats are linked to blood cholesterol are being discounted by some scientific studies. Raised blood cholesterol is a risk factor for heart disease, but there is no direct correlation between cholesterol in the diet and levels of blood cholesterol.

- For a certain period of time, Unilever sold a product marketed as being good for the heart when it was heavy on trans fats known to be bad for your heart. The process of hydrogenation has been phased out after professor Willett's publication.

- Labelling legislation may not allow me to access information I personally find useful. In America for instance, the FDA allows producers to label their product as 'trans fat free' if they contain less than 0.5g/serving. Yet, the cumulative effect of repetitive consumption of these fats has a negative impact on health.

- Processes of extraction from seeds to oil employed by the Industry to manufacture vegetable fat spread are numerous and could equally damage health. This suggests that the hydrogenation of oils may not be the only process that represents a risk for health in the production of vegetable fat spread or margarine. Most of these processes have not been thoroughly assessed.

- Finally, the amount of pesticide employed to grow the seeds used to produce vegetable fats can also have a negative impact on health.

Requesting Clarifications from Producer: This search raised a few questions regarding Flora spread. I decided to get in touch with Flora's customer care line (see Appendix B for email exchange) whose contact details were mentioned on the tub in order to obtain a few clarifications.

The answers I received during the call raised, in turn, a few questions and another bout of online search stated in an email sent to this department. A response was received a few weeks later. The following considerations emerged from these exchanges:

- Flora Heart Age contained no Hydrogenated oils. But Unilever still sold a product containing hydrogenated fats (Elmlea) which contradicted a statement made in 2006 by one of the company's spoke persons that the process had been phased out within two years of a study (Willett et al. 1993) which conclusively demonstrated the damaging impact of these fats on health.
- The process used to replace hydrogenation is called interesterifciation or fat-rearrangement.
- Another online search episode revealed that this process had not yet been researched sufficiently and the studies carried out so far were inconclusive.

❖ PERSONAL ASSESSMENT

The overall experience was useful as some of the information gathered on the Web appeared essential to me as a health-conscious consumer disposed to buy a comparatively more costly product to ensure physical wellness and therefore more prepared to investigate the rationale that underlies my

decision to do so. After the search, my assessment of the product differed greatly from the initial assessment carried out by means of the information provided by the manufacturer on the packaging, or when contacted. I felt the conduct of the company had not proven to be trustworthy and would have liked to register my position in a more compelling and active manner.

It was not necessarily easy to assimilate all the information found through the web, it was even at times destabilising, mostly because decisions had to be made about the merits of conflicting views, or because of some specialised knowledge I felt I needed to acquire to make a better judgement. However, the literature I had surveyed clearly indicated that Flora's health claims were not sufficiently supported by scientific evidence to justify my decision to buy this product or for these to be advertised on the label. There were, in particular, many processes employed by the producers throughout the life cycle of this fat spread that were not represented on the label and had not been adequately researched with respect to their impact on health. Ideally, I would need to be able to appreciate the current state of knowledge regarding the processes employed during the whole life cycle of the product, and also acknowledge the diversity of positions there is within the scientific community regarding these various processes to make a better judgement.

Another outcome of the search was the realisation that the knowledge acquired for this product was applicable to other products and could greatly modify my consumption pattern. The resolution to avoid any products that could contain these fats became strong. But despite being better-equipped to decipher labels, putting into practice my commitment was not necessarily easy. Reading every label to verify that the harmful fats were not present in the food I was interested in was quite taxing and it was not always possible to find a suitable alternative. Furthermore, I was not sure that even If I made such an effort, the label would really inform me as thoroughly as I needed to considering the manner in which the current labelling legislations allowed producer to conceal some of the information I was interested in. The best strategy I felt was available to me considering the lack of information was still to make the effort wherever I could and read the labels, in order to minimise the risk, knowing that I could still be exposed, turn to product that had butter and were organic and buy high quality oils whenever my budget allowed me to. This was not ideal, but pragmatic considering the limitations of the informational environment I was dealing with.

CASE STUDY 2 – MILK

This bottle of milk was purchased in Lidl – a German supermarket chain established in over twenty countries worldwide. The product itself is produced by Graham's - the Family Dairy, Scotland's largest independent dairy company.

❖ LABEL

Figure 3 - Organic milk product label.

The information available at the point of decision is printed on a label stuck to the bottle (Fig. 3). It includes essentially factual information on the nutritional value of the product, storage instructions, and the manufacturer's contact details. The label also displays information which

associates the product to quality assessment processes such as the 'Excellence Award'. Within this layout, the organic claim has a prominent position and is supported by organic certification references (UK5) and the 'Soil Association Organic Standard' logo. It is unclear what the certification 'UK5' relates to or the reference 'UK SC 011 EC' corresponds to. Finally, a short statement outlines the company's ethos in terms of ecological impact (using "farming methods that benefit the natural habitat on the farms and help support the wildlife) and the product's multiple benefits.

❖ **SEARCH**

Search Focus: The most prominent feature on this particular label concerns the organic claim and is the main reason which motivated the purchase. The Soil Association logo offers what can be perceived as a dependable form of validation, however, the organic certification 'UK5' suggests different levels of certification which significance is unclear.

In the same line of thought, it would be interesting to have more information on the manner in which the producer's methods positively contribute to the environment.

Online Search: The search focused on clarifying the organic certification references "UK5". Five sites were given greater attention during the online

search (see Appendix A for their URLs) and the following points emerged from consulting them:

- There is a large number of certifying bodies throughout the UK, Europe and outside of the E.U. zone. These agencies do not necessarily follow the same protocol to evaluate the organic status of the food we buy. For that reason and despite efforts on the part of international agencies such as the IFOAM (the International Federation of Organic Agriculture Movements) to institute global standards in terms of organic certification, organic claim cannot, in the present context, be considered informative from a consumer point of view.

- As a result, there is a difference between consumers perception with regard to the meaning of the term 'organic' and how this word is used in the Industry.

- This discrepancy also reveals a lack of consensus amongst organic producers themselves.

- Beyond the inconsistencies that can be noted with the processes of certification, and within the community of organic producers, there are also conflicting theories on the benefits of organic agriculture. In some instances, opposing views were substantiated by a scientific body of evidence, indicating a lack of consensus amongst experts.

Requesting Clarifications from Producer: The producer was not contacted for this product.

❖ PERSONAL ASSESSMENT

Although I decided to continue buying organic milk as much as my budget would allow me to, I felt limited in terms of information in two respects. Firstly, certification standards were not clearly defined. There were many views and practices pertaining to organic agriculture and I would have liked to be able to understand more about this to make a more informed choice. But gathering information so far had already been time-consuming and what I needed, after reflection, was simply much more than that. First I would need to understand the reasons for having various levels of certifications in order to decide which best represents my values. Although I 'instinctively' favour organic modes of production, I felt understanding the rational that accounts for the differences of opinion that exists amongst organic producers but also the one that exists amongst scientists regarding the virtues of organic agricultures would allow me to take better positions as a consumer.

CASE STUDY 3 – COFFEE

This pack of coffee was purchased in and manufactured by ASDA - a British supermarket chain which retails food, clothing, general merchandise, toys and financial services. And has become a subsidiary of the American retail giant Walmart, the world's largest retailer in 1999.

❖ LABEL

Figure 4 - Coffee product label.

The front of the packaging gives a brief description of the product that highlights the Fairtrade method of production. The back of the bag offers a satisfaction guarantee accompanied by the manufacturer's contact details, information relating to environmental aspects, design, weight, sell by date. Ingredients, handling information, statement on the company ethos, Fairtrade certification reference accompanied by a short story of the product in its country of origin are printed on the side of the bag (Fig.4).

❖ **SEARCH**

Search Focus: The Fairtrade certification influenced the decision to purchase the product and will be the focus of the search.

Online Search: The primary search was "Fairtrade certification". Five sites were given greater attention during the online search (see Appendix A for their URLs) and the following points emerged from consulting them:

Fairtrade Certification Mark is an independent consumer label that appears on products and signifies Fairtrade standards have been met. For Fairtrade certified goods, producers receive prices aimed at covering the cost of sustainable production. They also get an additional sum, called the Fairtrade Premium, for social, environmental and economic development.

- Fairtrade (in one word) is a labelling system governed by Fairtrade International. There are several *fairtrade* networks. Fair trade (which manage the Fairtrade label I am familiar with) is only one of organisations amongst others. In order to provide a single point of reference to the principles and definition of Fair Trade, The Charter of Fair Trade Principles was defined in 2009 that was signed by some of the main Fair Trade organisations.

- The standard-setting process is open and the organisation's website provide easy access to data and publications. The process also involves wide consultation with stakeholders.

- There is a number of criticisms against Fairtrade logics. Critics question how much of a benefit Fairtrade development really is to farmers who subscribe to the certification process, those who do not, and even consumers. Farmers do not necessarily make a substantial profit from adhering to this system or may not be able to make the radical changes that would allow them to break out of the poverty cycle. In other words, some of the changes of practices encouraged by the Fair Trade organisations are questionable from an agricultural, social, and economic point of view. Economically speaking, the Fairtrade minimum price means that when the world market price collapses, a significant number of the poorest non-Fairtrade farmers can be affected. Finally, producers only seem to receive a fraction of the extra cost paid by consumers.

- Although there is only one label, there are many products and the merits of the Fairtrade reasoning seem less justify in some cases. (e.g. Selling Fairtrade Apples from South Africa in the U.K. does not make much sense from a sustainability perspective)
- Composite products can be certified Fairtrade if at least fifty percent of their ingredients are Fairtrade. This information is not mentioned on the label.

Requesting Clarifications from Producer: The producer was not contacted for this product.

❖ PERSONAL ASSESSMENT

Being able to understand more about the significance of the Fairtrade certification helped me gained a more nuanced perception of the product I bought. First, it reinforced my commitment towards Fairtrade products. By contrast with the organic certification, the Fairtrade accreditation process here appeared more consistent through being sustained by an international system of monitoring, auditing and certification. The Fairtrade website was a good source of information which aimed at transparency, offered graphs, independent reports. It offered a great deal of relevant information and a clear FAQ page that offered clear explanations, at times on sensitive questions.

However, I felt the information about composite products certified Fairtrade ought to be on the label of these products rather than on the FAQ page.

Criticisms concerning the Fairtrade certification were present but not damaging in my opinion. In some instances though, I felt they were pertinent and would need a follow-up as they could influence my buying strategies with some specific products. For instance, and although I would continue to support Fairtrade products whenever possible, I found that given the choice, I would choose a local product over the same Fairtrade product as a concern for "food miles". Being aware of this critic was informative and helped me make a decision that better reflected my position.

CASE STUDY 4 – SOCKS

These socks were bought in and produced by Marks & Spencer - an important British retailer with a significant presence abroad and that specialises in the selling of clothing and luxury food products.

❖ LABEL

Figure 5 - Socks product label.

This label has a relatively small amount of information, mostly about the merits of the products in terms of design. There are also a couple of mentions concerning environmental aspects, care instructions, composition, country of origin, and producer's contact details (Fig. 5).

❖ **SEARCH**

Search Focus: The most prominent feature on this particular label refers to the claim that 'silver technology' "keep socks fresh and odour free for the life time of the sock"

Online Search: The primary search expression was "silver technology". Five sites were given greater attention during the online search (see Appendix A for their URLs) and the following points emerged from consulting them:

There is an increasing number of nanomaterials that are added to consumer products out of which silver nanoparticles represent a significant portion.

- Silver particles are employed because of their antibacterial properties. In the case of socks, they are advertised as reducing

sock odours and foot infection, an attribute that can be particularly attractive to athletes or diabetic people for instance.

- Silver has been used for medicinal purposes for at least a century in many different places across the world.
- However, the independent scientific community warns that at the nanoscale, the chemistry is different and that the data currently available cannot establish that silver nanoparticles present no danger for health or the environment.
- On the contrary, studies have shown that silver nanoparticles (and particles at a larger scale) could potentially pose a serious environmental problem when they are released in the environment.
- These particles are released in the water cycle when socks are washed. In some cases, silver technology socks could release up to 100% of their nanoparticles in only a few washes.

Requesting Clarifications from Producer: This search raised many questions. I contacted Sanitized, the company that supplies the Silver technology through a contact form located on their website (see Appendix C for detail of query and reply received).

❖ PERSONAL ASSESSMENT

The information obtained on the web considerably changed my perception of the product. The concerns expressed by some consumers, and by some scientists who were not associated to the industry, contrasted with the enthusiasm that led the industry to exploit the prodigious and endless possibilities offered by nanomaterials. But within the current informational arrangement, it is difficult to not feel overwhelmed intellectually and emotionally by the literature available online. Furthermore, it would be impossible for me to know which products contain these materials and which products do not, which application are safe and which are not? It appears that silver nanoparticles, as well as nanomaterials in general are rapidly submerging the consumer market although they have not been sufficiently researched.

In the case of the product I bought, studies clearly showed that all brands of silver sock release silver, some more than others. In any case this contradicted the claim made by the producer on the label and the statement made by Sanitized when I contacted them. Has the producer taken into account these studies since they have been released? Has the product been improved since then? If the design has been improved, does this mean the environmental impact is no longer a concern that needs to be researched? Having an updated understanding of how these types of questions have been answered or not answered would help me make a more informed decision when it comes to the product I bought. There may also be questions I have

not yet been thinking about that may be very pertinent for me to take an informed decision.

Being able to communicate with the supplier who provides this technology is a good step in the right direction, but it takes an extraordinary amount of knowledge, attention and skill to formulate a query capable of generating a satisfying response. The response I received was meant to be reassuring and authoritative but it was still in conflict with dependable sources within the scholarly community. After another web search episode, there were more arguments supported by more pertinent evidence that could be submitted to the supplier. But somehow, even if I was to decide to send a new query to the supplier, the response I would obtain may not be verifiable...or it would take, once again, a considerable amount of energy to investigate thoroughly. In the meantime, the status of knowledge or the manufacturing methods could evolve further and other more pertinent questions could be formulated. In addition, even if my personal awareness of the environmental impact of the product increased, the majority of consumers would not be exposed to the literature produced by the expert community in the same way. These 'nano-products' would continue to submerge the market and silver nanoparticles would continue to be rapidly be released in the environment.

CASE STUDY 5 – WOOD

This small wooden deck post cap was purchased in B&Q – a British retailer of DIY and home improvement tools and supplies.

- LABEL

Figure 6 - Wood product label.

Little information is available here. It is printed on two small labels stapled on one side of the product. The first label contains the Bar code, the product name, two references which meaning or function may not be evident from a buyer's perspective, and the mention 'tanalised'. The second label references what appears to be a certification which value cannot be appreciated without specific prior knowledge (Fig. 6).

❖ **SEARCH**

Search Focus: The search will focus on clarifying the meaning of 'tanalised' and "FSC".

Online Search: The primary search words were "tanalised" and "FSC". Five sites were given greater attention when searching for the word "tantalised" and another three when gathering information about the acronym "FSC" (see Appendix A for their URLs). The following points emerged from consulting them:

Tanalised

- The tanalising process (also referred to as CCA) is used by the industry to preserve wood. Wooden products which are tanalised are impregnated under pressure with highly toxic substances to protect against rot. Burning tanalised wood releases arsenic, a cumulative poison, into our immediate atmosphere.

- Some sites reports that this a safe product and it can be used in sensitive area (garden plots, wildlife)
- There is a growing body of scientific evidence that timber treated with CCA poses a danger to both humans and the environment.
- Some countries like the US, Canada, Europe, Australia have restricted (rather than abolished) its use. In New Zealand, however, the Environmental Risk Management Authority, reviewing the same data that prompted the actions elsewhere, concluded that there was no reason to restrict CCA use for any applications.
- There are very few alternatives within the price range of most people. But they exist; Tung oil for instance is a greener option to preserve wood and has been used in China since 400BC.

FSC

- FSC stands for Forest Stewardship Council and is an independent, non-governmental, not-for-profit organization established to promote the responsible management of the world's forests. FSC provides internationally recognized standard-setting, trademark assurance and accreditation services to companies, organizations, and communities interested in responsible forestry. The FSC label aims at providing a credible link between responsible production and consumption of forest products, enabling consumers and

businesses to make purchasing decisions that benefit people and the environment as well as providing ongoing business value.

- FSC-WATCH is an organisation that is dedicated to encouraging scrutiny of the FSC's activities. This organisation has reported many issues with this certification process, offering links to documentaries from reputable news sources that efficiently exposed serious inconsistencies. (Al Jazeera 2011)

Requesting Clarifications from Producer: As no contact details were available on the product itself, I contacted B&Q in order to obtain more information on the degree of toxicity of the tanalising process that had been used in this particular case and on the fact that no warning sign or instructions on how to handle the product to minimize any adverse effect were mentioned on the label..

- Regarding the hazardous nature of the product, the floor staff indicated that this tanalised product was not harmful except if burnt or sawed.

- Regarding the suggestion to add to the label this key information, the manager informed the staff I liaised with, that mentioning "tanalised" on the product label had been considered sufficient by the company, however an email would be sent internally to highlight my query.

- When I asked whether it would be possible to be kept informed on any progress regarding this query, I was told it would, unfortunately, have to be dealt with internally but that I could contact B&Q Head Office If I felt it necessary to do so.

❖ PERSONAL ASSESSMENT

In this case again, there is an overwhelming gap between the perception inherited from the label and the assessment I made of the product after the search. The complementary information gathered online led to the following observations:

- ❖ Critical information concerning the toxicity of the product was missing on the label. Moreover, there were no handling instructions (e.g. no sawing without protection, no burning, not to be used in certain areas where the environmental consequences could be significant, etc...)

- ❖ Regarding the FSC standard, there were discrepancies between the perception of validation the standard purports to convey and the issues raised by a dedicated watchdog-type and an investigation documentary from a reliable news channel.

In conclusion, there were several key pieces of information that were missing and the information displayed on the label was misleading at the

point of decision/purchase. Critical pieces of information found on the Internet were often well documented and referenced. Finally the manner in which the retailer dealt with the concern was unsatisfactory in two respects. Firstly, the expectation that all consumers would know what the process entails was unrealistic. On these grounds the company's judgement that the information on the label is sufficient appeared unwarranted. Secondly, the fact that this valid concern was dealt internally and that no feedback would be transmitted on the progress of the query demonstrated a lack of concern for consumer's rights to know, and as a consequence their well-being. This also demonstrated a lack of concern for the company floor staff who handled this material on a daily basis without being properly informed, trained and equipped.

CHAPTER 2 - SYNTHESIS

This chapter presents the synthesis of the analysis conducted in the previous section. A similar progression as the one used for the case study is adopted to present the observations that are being made (i.e. current label observations, search for complementary information, and personal assessment). The primary objective of this synthesis is to identify main issues with the informational environment that informs consumers about the products they use and determine high-level requirements for the elaboration of a more coherent information arrangement. When relevant, the comments in the paragraphs below are general and apply to labels beyond the ones that have been selected for this study.

1. ISSUES WITH CURRENT LABELS

There are two main issues with current labels. The information they provide is difficult to understand - whether it be in terms of presentation or content. The information presented is also limited.

The space available on current labels is governed by physical constraints. For this reason, many labels can be difficult to read. Characters fonts may be too small and not accessible to a large number of consumers. In addition, each packaging will adopt its own particular layout. This means, basic information (weight, ingredients, handling, etc...) can be located in a different

place each time. The scantiness of space also leads producers to be particularly economical with the information they provide to consumers. What appears on labels will conform to regulations imposed by the legislator but it will be presented through the filter of highly sophisticated marketing strategies. In other words, it will be in the interest of producers to use presentation techniques to their advantage and put forward the information that has been deemed as having advertising virtues rather than informative value from a consumer perspective.

The information contained on labels can also be difficult to make sense of, due to the fact that it is not standardised, often requires further explanations or specialised knowledge or translation when it comes to foreign products. For instance, nutritional tables need clarifications regarding the referential used to make measurements, or more specific knowledge on the types of ingredients that are used and their impact on health. It would also require, more refined knowledge with respect to individual requirements to help make this data usable to any particular consumer. Codes that are used to identify food additives (E+Number) are meaningless to consumers. Certifications and what they correspond to are unclear.

Finally, there are a lot of different types of information that directly concerns the product we use and that consumers may find critical which is not displayed on current labels. These can relate to any aspects of the

product life cycle, from conception to manufacturing and through to important information about how to use the product.

2. Issues with Searching for Complementary Information

The two sources that have been used to obtain complementary information (i.e. Internet and Producer) presented both a number of difficulties. First and foremost, these searches required a tremendous amount of attention and were particularly time-consuming, two resources that are not necessarily available to consumers at the point of decision/purchase. Going through the search process was also confusing at times.

Despite these inconveniences, the complement of information collected through the Internet could be, on occasion, particularly pertinent. There is now a wealth of information available to consumers online. However, this information can be difficult to filter, interpret or assimilate. There is a great variety of types or sources, and different levels of significance or validity. This abundance of information would need to be organised to become more useful.

The possibility to collect more information directly from producers is a welcome contingency. Manufacturers make themselves increasingly available to consumers through highly sophisticated customer care line. However, the complement of information obtained from this source can fail to match expectations. Arguments presented by the manufacturers could often be

challenged by the information available online and revealed to be lacking depth or consistency. Organised independent groups such as consumer associations, or news agencies were often a competent and reliable source of information.

The study also exposed the inadequacies of the verification process we now rely on, and in particular, its opacity. Indeed, as a form of validation, companies can refer to studies whose methodological integrity could not be fully appreciated and monitoring processes whose protocol could not be reviewed. Understanding the merits and deficits of the standards and methods employed to establish on the market the products we consume is a critical class of data that is not readily accessible to consumers. In addition, the verification process implies a certain complexity and dynamism which may be difficult to render and follow up. Not all information can be verified in the same manner, and the state of knowledge that surrounds the product we use constantly evolves.

The online scientific community offered key background information in terms of verification. Nevertheless, the wide disparity amongst published results suggested some deeper methodological issues which, at first, made the information difficult to conceptually understand. However, becoming aware of what is known, of what we yet need to be researched to attain a more robust level of understanding, of the diversity of competing positions, their theoretical status and the manner in which they progress, offered a more

realistic viewpoint, and potentially, better conditions to perform assessments and make decisions.

There could also be discrepancies between the perspectives of independent scientists and the part of the scientific community that was associated to the industry, and also between the perspectives adopted by governments or international health agencies that took part in regulating labelling activities. Labels did not necessarily reflect the current state of knowledge. In some instances, the Internet offered a forum where these inconsistencies could be brought to light and debated, although not necessarily in a consistent or effective manner.

3. Issues with Carrying out a Personal Assessment

In every case, there was a discrepancy between the perception of the product inherited from the label and the one fostered by the online search.

The knowledge acquired from the search activity was not necessarily easy to assimilate or put in practice. There may be several reasons to account for this difficulty and in particular the fact that our decisions as consumers are also conditioned by our values and personal circumstances. Both these aspects are complex notions that constantly evolve. Our values can affect our consumption patterns on religious or political ground for instance. Labels in their present state, do not allow these values to easily manifest. It is demanding for vegetarian for instance to verify that all the ingredients used in

each product meet their standards. For the same reason, it would be difficult for someone who wishes to boycott a product from a particular country on political grounds to do so in practice. Also, circumstances often dictates what goods will be bought, based on financial, health, or geographical grounds. In today's informational environment, it is difficult to find the optimum solution to negotiate circumstances and remain consistent with our personal values.

In conclusion, the labelling system in place to inform consumers is cumbersome and fails to address critical informational requirements. The key issues that have been identified in this study would need to be addressed to develop a more consistent information environment. These issues can be summarised as follows:

- The information available on current consumer labels is difficult to understand and is also limited.
- There is a vast amount of information now available online that can be pertinent to consumers. Various participants create various types of information that have different levels of relevance and importance. This wealth of information needs to be filtered, organised and validated to be more easily interpreted and assimilated by consumers.
- From a consumer perspective, being better informed may not necessarily translate into more consistent forms of actions. Decisions consumers make, are conditioned by personal values and

circumstances. These are in themselves complex notions that are difficult to put in relation with the information obtained about the products we use.

The following chapter presents an architecture that engages with these aspects.

PART II: ARCHITECTURAL ELABORATION

Just a thought...

What if we could visualise and engage with the context, the system of values and social significance of some of the information we use? ...For instance... what if when we bought products on our virtual shelves, we could meaningfully explore their labels, conveniently interact with the socio-ethical context attached to each one of them and understand how this context evolves, how much of it is transparent, verifiable, stable, consistent, ...and evaluate in what way it corresponds to our own values?

This section presents the conceptual development of an architecture meant to improve the quality of the information which belongs to the public domain by providing consumers with a valuable context at the point of decision or interest in the case of widely used consumer products. The system emphasises two aspects: *awareness* and *action*. Awareness is achieved by allowing users to explore (1) the context of the product they use and (2) its associated verification data in a critical manner; action is promoted by establishing mechanisms which on the one hand (3) engage all consumers to participate to the evolution of the products they have an interest for and, on the other hand, (4) allow them to select courses of actions more in line with their own preferences and circumstances. In Chapter 3, these four key processes are developed with regard to the observations made in the previous chapters and a high level architecture is proposed. In Chapter 4, the digital labelling system developed from this conceptual exercise is applied to consumer products and described in terms of user experiences. Chapter 5 gives an assessment of the architecture proposed in this study, surveys current alternative approaches that engage with the notion of quality in public information systems. This last chapter also discusses the potential and challenges of a consumer digital label.

CHAPTER 3 – CONCEPTUAL DEVELOPMENT

DESIGN INTENTION

Digital models of communication are ridded of the various constraints imposed by the printing model and for that reason can profoundly modify our rapport with information. Today, there is a clear desire to elucidate the potential which new technologies offer to organise information in more effective ways and a host of research projects to that end. In his insightful Web presentation "It's Not Information Overload. It's Filter Failure" Clay Shirky (2008) invites us to entirely rethink social norms. According to him, updating information systems inherited from the printing model cannot offer a good response to the information overload we now often experience with the advent of the digital revolution. Understanding what social filters have broken - or need to promoted -, on the other hand, may provide some clues as to where to put the design effort and may help us conceive more relevant systems of information.

The system proposed in this study considers information situations which clearly belongs to the public sphere and suggests 'ethics' is a 'broken' filter. More specifically the system aims at fostering quality by organising information which good management can significantly affect public life according to an open ethical frame of reference complete with a set of interpretive and decision making tools. Ethics is a highly connoted term, and it may be necessary to clarify what is meant

by ethics in this particular context. Here ethics is a concrete method of appreciation to handle routine yet complex information situations such as those relating to the goods we consume. The system itself acts essentially as a 'quality filter which rather than eliminate complexity, allows users to handle it. On this account, the definition of quality put forward through the structure becomes distinctly 'sociological,' in that it focuses on cultural and environmental dimensions while offering individuals a space to formulate and negotiate values through rational means.

Structuring information in that manner, would in theory respond to social expectations in terms of transparency of a number of information situations. It would also ensure, on the part of users, a more active participation to the evolution of key information situations that are at the heart of economic activities.

In order to provide this rich informational environment, the system lays emphasis on two aspects, namely: awareness and action (Fig. 7). Awareness and action are defined in this case as follows:

> **Awareness** describes a critical process of appreciation and is achieved on the basis that information situations that clearly belong to the public domain, in order to be assessed by users need to be:
>
> 1. contextualised according to essentially ethical themes.
> 2. verified within a more nuanced cognitive environment,

Action describes an active form of engagement which depends here on the possibility users have

3. to participate to the evolution of the context of the product and service they use and also
4. to position themselves by selecting courses of action more in relation with their own values and particular circumstances.

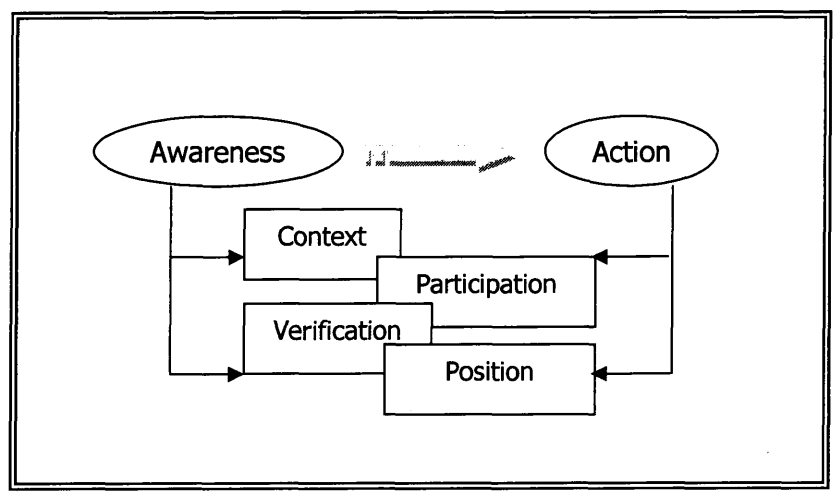

Figure 7 - System function.

OVERALL SYSTEM DESCRIPTION

Unlike physical labels, the information provided by the suggested digital label is dynamic, interactive, and adjustable. It is managed in an open and principled manner using collaborative logics.

This digital system would make use of various innovations and would be supported mostly by the many recent advances in 'locative' technologies, which can readily associate real-time information to products any time, any place, and on the front end by, essentially, developments in Usability including visualisation of complex systems. These aspects are not discussed here. Instead, the focus is on developing and evaluating the potential of an information arrangement derived from the four mechanisms described above in the case of widely used consumer products.

The three first mechanisms, namely *contextualisation*, *verification* and *participation* are the organising principles of a public database that can generate real-time digital *global labels*. The fourth mechanism, *position*, exploits the information collected in the database in order to increase relevance by offering users a platform where their preferences can be registered in order to manage global labels in a more personalised manner and select courses of action more in line with their own values and circumstances (Fig. 8).

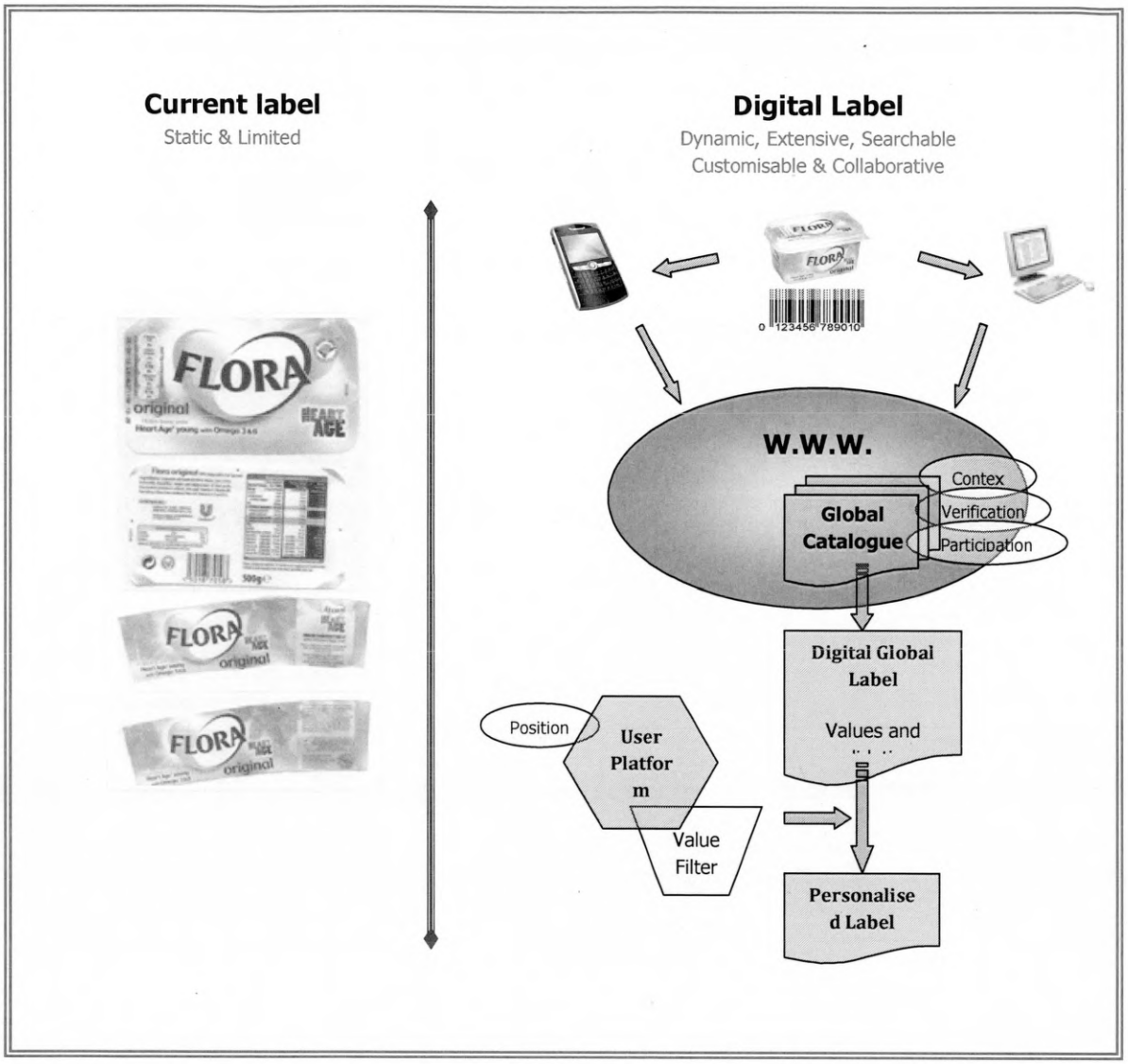

Figure 8 – Current label and digital label models.

MECHANISM OF CONTEXTUALISATION

The analysis of current labels, in the previous chapters, demonstrated that the current labelling system did not give access to information that could be considered essential by consumers and that could significantly influence their

assessment of the product they are interested in. Information debated by the public (on the news, in forums, privately, etc...) and that closely relates to the product we use is generally dissociated, in time and location, from the product itself. However, some of this information is valuable and may be deemed essential by consumers. Most of this information can now be explored on the Internet albeit in a format which at times is not necessarily easy to assimilate or verify.

The primary role of the digital label is to draw critical pieces of information closer to the product and make it conveniently accessible to online users by organising it within a contextual representation of the product life cycle (Fig. 9). This contextual arrangement constitutes the base of the digital label and is the first step towards helping streamline and filter the vast amount of information that relates to the products we use into a database. This database should allow the public to query data relating to the various processes employed during the entire life cycle of the product together with their associated verification data when available.

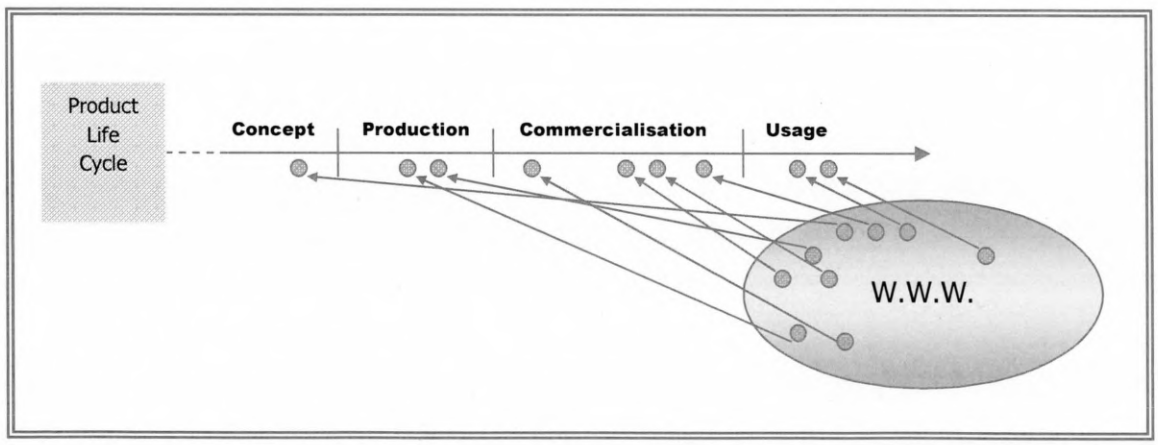

Figure 9 - Using the product life cycle to organise information.

However, the context of a product may remain dense and complex and for that reason difficult to represent or conveniently query and assess.

Questions consumers have relate to various aspects of the product life cycle, and this cycle nowadays is likely to be extensive as most products we use become increasingly sophisticated. A multitude of processes partakes to every portion of the life cycle and tracking these processes and evaluating their merits can be fastidious. In addition, the digital label aims at representing the 'entire' life cycle of the product, that is to say, from conceptualisation to usage. All these processes are dynamic; they may change quickly and be replaced by new processes. Finally, they may not be easily evaluated, because they may not be transparent or may not be adequately monitored.

Under these conditions, attempts on the part of consumers to better understand the product they use remain laborious and can still lead to a confusing accumulation of data that cannot be easily managed in a cognitive sense.

When considered jointly, all four mechanisms will address this problem. But at the contextual level, the digital label proposes to treat it by organising the description of the processes according to socio-ethical themes. Each process becomes susceptible of being evaluated in that manner and the label becomes essentially an account of this comprehensive evaluation.

Most of the questions consumers have relate, to a large extent, to the merits of the product they consume and the manner in which the product can

benefit their short and long-term interests. These concerns can be meaningfully debated using ethical themes. Offering consumers a dialogical environment where arguments can be organised around these themes may also help reduce complexity and increase relevance by directly addressing the fundamentals of the consumerist rationale.

In practice, how can this ethical evaluation be envisaged in the case of consumer goods?

The system proposes to conduct the evaluation from two different topical areas. The first is concerned with the manner in which the product is manufactured, commercialised and used and the second examines the merits of the product itself. This two-tiered evaluation can be translated into the five following key questions:

- What is the impact of the product on the environment?
- What is the impact of the product in terms of social equity?
- What is the impact of the product on health?
- What is the utility of the product?
- How well designed is the product?

Figure 10 below presents these themes with relation to the product life cycle.

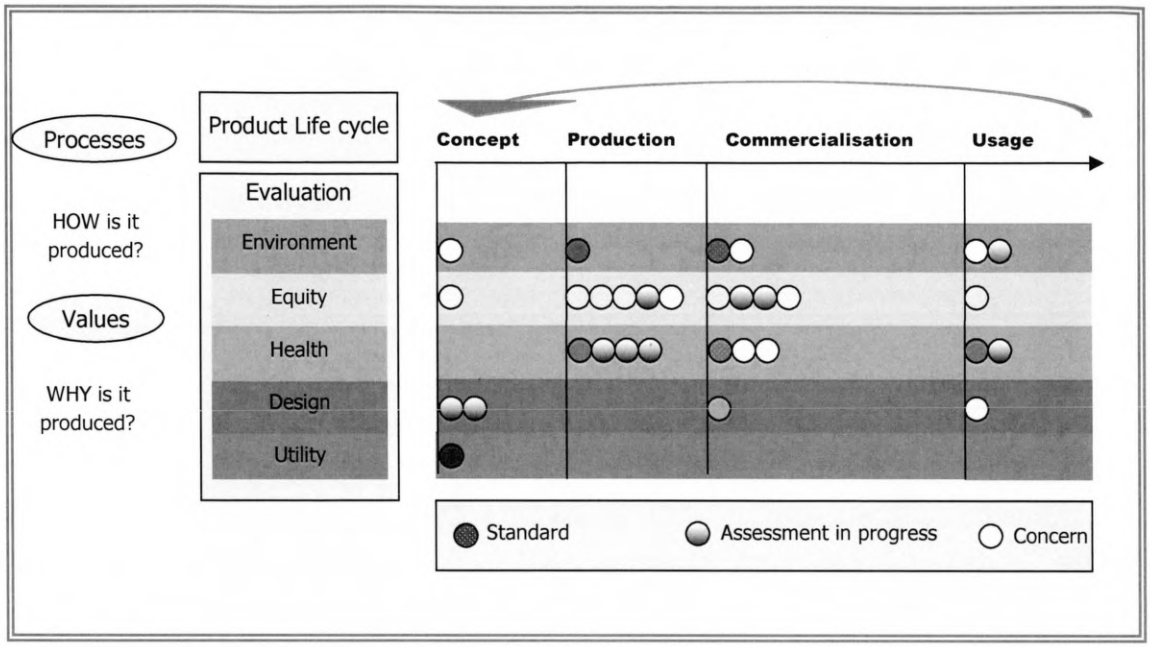

Figure 10 - Themed contextual life cycle.

These core themes reflect shared concerns amongst consumers, and the increasing popularity of standards such as 'organic' or 'Fairtrade' could be deemed as an indicator of the growing interest there is for such questions. However, standards available today to inform consumers remain limited, and when available, can be insufficiently developed or simply awkward to interpret.

The case studies revealed that standards would only assess a limited segment of the product life cycle while other segments remain un-scrutinised. For instance, in the 'sock study' or the 'treated wood study', one could argue that standards to evaluate the impact of both these products on the environment were missing. In the 'fat spread study', the health claim and endorsement of the product by the Heart Foundation remained open to criticism and deceptive in the light of the science available while the safety of the process which replaced

hydrogenation did not appear sufficiently researched; in the milk study, understanding what the 'organic' certification corresponded to unveiled a contrast between consumer perception and unpublicised facts.

This partial and incomplete evaluation may not permit consumers to form realistic expectations regarding the product they use.

The contextual representation proposes to accommodate and document the evolution of established standards as well as offer the possibility to develop and manage new standards able to deal with the whole array of key concerns identified earlier. In the system, standards are regarded as the formalised outcome of a principled discussion where propositions made by producers, concerns expressed by consumers, and verification data collected by the experts and managed by the regulator coalesce to form a dynamic and useful description of the product.

In that manner, the proposed label is, at its core, a comprehensive overview of the processes of evaluation that are employed or may need to be used to assess the product throughout its entire life cycle. Essentially, it provides users with clear definitions and gives access to the criteria that are used to elaborate standards. In a digital format, users can approach this overview at different levels of detail. More importantly, a digital representation can be customised to facilitate interpretation and transcribe the inherent dynamic nature of the evaluation process into an accessible cognitive experience. The characteristics of the interface required to convey this rich cognitive environment

will be outlined in the verification interface section below, the third mechanism of the digital label.

Each process of evaluation is organised along ethical themes that assess the manner in which the product is produced as well as its utility and usability. Four sources of inputs initiate this principled and open assessment (1) the *concern* raised by consumers, (2) the assessment carried out by experts, (3) the standard managed by the regulators, all of which evaluate (4) the 'solution' provided by the producers to meet consumer's needs. The participation section below discusses the manner in which such an exchange between the various stakeholders of the label can be envisaged to generate the principled elaboration of standards and organised to highlight issues of high importance on the front end of the global label.

MECHANISM OF PARTICIPATION

Two main concepts are discussed in this section: (1) the nature and role of each class of participants and (2) the manner in which the information is transacted and prioritised between these various groups.

Information in the printing era can be basically symbolised as a process where a sender creates a message while, at the other end, a receiver is stimulated by this message. The information, in such a model, is flat and

hierarchical. At the digital stage of the information economy, network properties engender a fundamentally different model and therefore different dynamics. Senders can be receivers and the information is no longer influenced by a unique source. Information becomes effectively collaboration (Fig.11). In addition, within this 'commons-based peer production' model, as Benkler refers to it (2006), producing and distributing information is no longer constrained by the same sets of restrictions. Passive users have the possibility to become active participants and treat a voluminous amount of information.

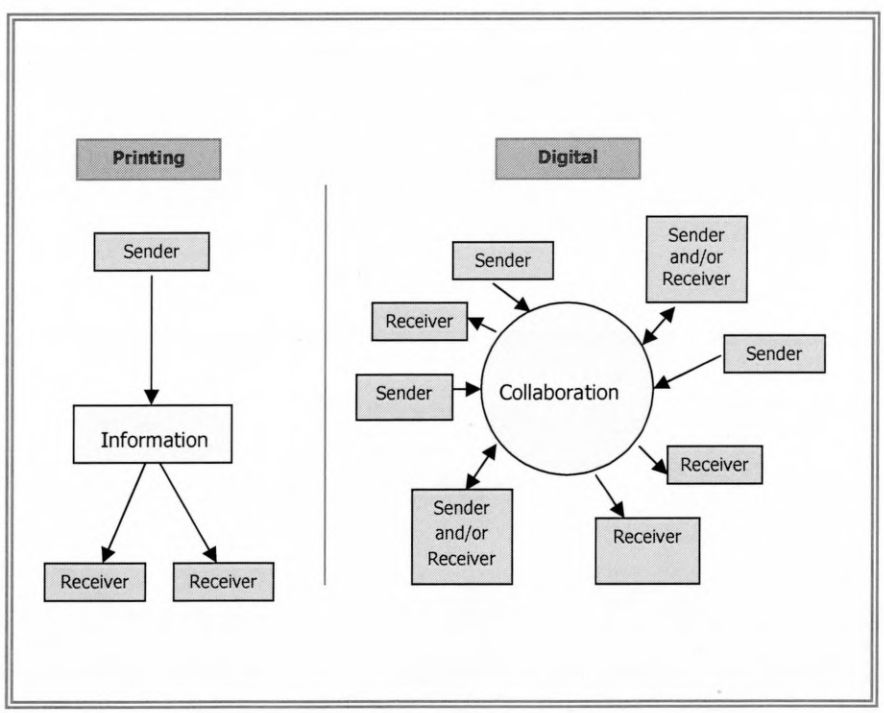

Figure 11 - Printing and digital models.

This redefinition of information ownership has necessarily some profound implications. For one thing, it allows redefining the balance of power between the various stakeholders of the label.

In the printing age, technological circumstances demand that the manufacturer 'own' the label. More specifically, the production of a label has to be managed by manufacturers, overseen by regulatory agencies who seek the advice of experts in order to better serve consumers. Information transactions between these various parties is rigidly compartmentalised, slow, incomplete and discontinued opening the way to inconsistencies at various levels. An informational arrangement of that kind is, by nature, asymmetric and can stimulate the expression of 'unproductive' conflicts of interests. Conflicts of interests will necessarily occur between the various stakeholders of a label, but under current conditions, the influence of those who do not directly 'own' the label is reduced and can be seen to lag behind. This is particularly evident in the case of consumers and phenomenon like the emergence of consumer associations can be seen as an attempt to correct this unbalance. In the digital age, this somewhat limiting form of informational organisation can be renounced and the label can be 'owned' by all those who have a stake in the product.

Indeed digital logics offer an opportunity to adjust the balance by providing more accurate and functional representations of the informational requirements specific to the various actors engaged in the production-consumption cycle. On this account, the digital label can become a public space where the role and

interests of each group can be clearly acknowledged and where structured debates can take place and contribute to the evolution of the products we use.

More explicitly, the primary function of a deliberative process of this kind would be to collectively regulate product standards within a shared and constantly evolving appreciation of the mechanisms that serve to establish views and values in the public domain. Underlying this proposition is the idea that product design is better conceived as a shared and dynamic process that requires active participation and constant interactions between those who produce, those who consume, and any agents that may assist these two entities in their interactions.

In a sense, the application, in recent times, of more user-centred communication methods to various areas of public life signals a notable interest for more participative forms of interactions. Many governments have recognised the significance of being able to engage at that communicative level and their agencies are now becoming more attuned to citizens' informational requirements by providing more opportunities for the expression of transparency and accountability. Following that trend, companies, and in particular big corporations, have also opened themselves to consumers by investing in always more sophisticated forms of customer services. These services are essentially assigned the tasks of responding to consumers' various concerns and of collecting user feedback whenever possible. But as the label analysis suggests, and however sophisticated the machinery may be, this communication system may not be capable of guaranteeing, in its current state of conception, a rich and

mature informational environment to users where conflicts of interest could be acknowledged and managed in a more proactive manner.

Within the new technological setting, we find ourselves faced with the delicate task of organising these transactions in a more meaningful way.

The challenge here is to define the role and relationship between the various label's stakeholders in order to create a rich and open environment where data, information, and arguments which relate to the context can be managed in a principled manner and acquire a qualitative edge.

At this stage of reflection, four kinds of stakeholders are identified: consumers, experts, regulators and producers. The first two communities, consumers and experts, represent firmly rooted cultural concepts. The community of consumers illustrates, in a sense, a quest towards exploiting resources to maximise our conceptions of well-being in terms of comfort, security, etc...For its part, the community of experts, illustrates the quest towards exploiting knowledge to maximise the exploitation of resources. By contrast, the role of the regulator and the producer appear to be circumstantial and the result of technological and sociological developments. They reflect an organisational mode where information and tasks are currently compartmentalised and localised. In today's context, their role could be reassessed. Within the digital product label architecture, the respective role of these four communities is define as follows:

1. Consumers

The first community of participants are consumers and those who represent their interests.

Consumers need to be able to evaluate the short-term and long-term merits of the products they use and make decisions that reflect their values. In order to achieve this end, they need, in the first instance, to be able to formulate queries that reflect their concerns. They also need to transmit feedback about the product they use. Providing consumers a platform where these forms of interventions are promoted can significantly influence the manner in which consumer products evolve.

The formulation of consumer queries may be informed and structured by various entities such as private individuals, the media, groups and associations from the civil society and, in particular, by those who clearly represent consumer's interest and have the lexical and organisational experience to manage any concern effectively. This would be the case with consumer defence groups for instance but also, in some instances, news agencies. Both these groups can reveal to be a competent and reliable source of information. They have experience in prioritising, documenting and exposing issues and are an articulate and powerful voice for consumers to negotiate with producers and government agencies. Unfortunately, at the

moment, their influence is too punctual and consumers may not necessarily seek their expertise.

Essentially, these various clusters of participants may all detain bits of information that could be deemed useful for the rest of the community. However, information is not necessarily relayed in a coherent manner between the members of the community. Efforts made by some members to elaborate a piece of authoritative information may not be acknowledged, may be duplicated or marginalised. Under such circumstances, informational transactions may not be able to achieve their potential.

The digital label aims at responding to these shortages by offering an environment that helps build, retain and share meaningful arguments. In a sense, the system does not create new groups of users; rather it arranges informational transactions between existing groups more resourcefully.

Lines of arguments in the system are described as *concerns. Concerns* rely on the contextual life cycle of the product to structure and log arguments.

The topical arrangement of the contextual base offers a comprehensive background for consumers to formulate their concerns. It can help classify and structure more pertinent forms of queries and streamline arguments more consistently. Below is a review of these key themes and the questions they give rise to:

- ENVIRONMENT: What is the impact of the product on the environment?
- EQUITY: What is the impact of the product in terms of social equity?

- ❖ HEALTH: What is the impact of the product on health?
- ❖ UTILITY: What is the utility of the product?
- ❖ DESIGN: How well designed is the product?

If we recall the example on vegetable fat spread, the evaluation of the merits of the product from a health perspective focused on the subject of hydrogenated fats and led to various categories of arguments and, eventually, to concerns on the replacement process called *interesterification*. There were also doubts cast on the theory that claimed that saturated fats like butter were linked to blood cholesterol. All these interrogations are concerns that relate to health. From a consumer perspective, an overview of all the possible concerns that pertain to the product is necessary to carry out an assessment and form more realistic expectations. Focusing on one particular aspect could be misleading. In other words, knowing that the product no longer contains hydrogenated fats does not guarantee the health merits of the product. Once the *concern* is *ethically* contextualised, the verification requirements can be determined and the experts can research the matter. This process will allow the consumer community to determine the significance of the concern, and the sort of actions that can be devised to address the issue and establish a *standard* (Fig.12).

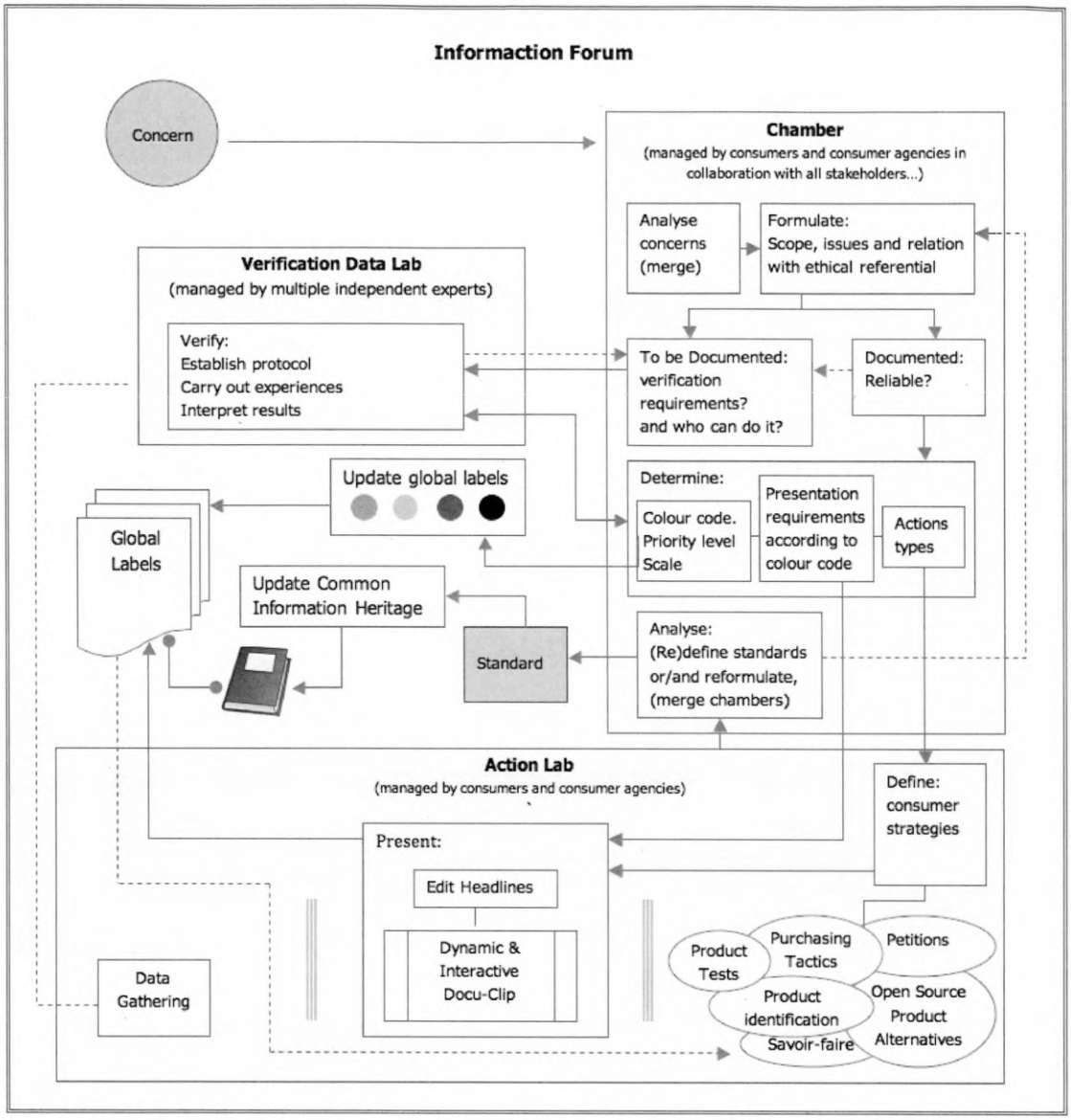

Figure 12 - Informaction Forum. The arrows depict the information flow, which may not be necessarily linear. Dotted lines represent optional relationships while filled lines represent mandatory relationships

The *Information Forum* diagram above offers a schematic view of the flow of information that is possible using the environment provided by the three mechanisms that have been discussed up to now.

The flow starts with a *concern* (in blue circle) that represents any type of query or type of concern consumers may have regarding a product. It leads to a *standard* (in blue square) which represent the reference or set of references.

Consumers are the pivotal community of stakeholders in the system. They manage the overall flow of information concerning the product they use. The other three communities, further discussed below, work in collaboration with the consumers.

Step 1: The *Chamber*

The *Chamber* is entirely managed by consumers. A *concern* is first analysed and formulated in terms of its relation with the ethical referential of the product life cycle, and when necessary merged with other concerns possibly at other scales, in order to streamline the discussion and the treatment of this concern.

Verification requirements are then identified. Requirements include the establishment of a protocol and the identification of the best expert agency to conduct the verification.

Step 2: The *Verification Data Lab*

The *concern* is then verified according to the established, and when necessary revised, protocol. The status of the verification process is updated, e.g., colour-

coded, according to the state of knowledge and importance of the issue in collaboration with the *Chamber.*

Step 3: The *Chamber*

This assessment can be transferred to the global label of the product. Thus if an issue is assessed as an alert, it can directly be highlighted onto each product label in *the Consumers Global Assessment* section of the *Global Label* (see global label Fig. 16). The *Chamber* also determines the types of actions that may be useful to treat the assessed concern.

Step 4: The *Action Lab*

The action types requirements allow the *Action Lab* to define consumer strategies. These strategies can include petitions, purchasing tactics, alternatives, and any type of action that can help address a concern constructively.

These actions together with the deliberations that have taken place to formulate, analyse and verify the concern that is under consideration are communicated to all the global labels that are associated to this concern.

Step 5: The *Chamber*

All deliberations and actions lead to the establishment of a *standard* which background and definition can be recorded in a *Common Information Heritage* Database.

2. Experts

The community of experts establish the verification protocols, gather the verification data and offer a balanced description of the state of knowledge.

Not all information can be verified in the same manner and a protocol of verification will need to be established according to the nature of the situation. But most importantly, this protocol can and need to be made accessible to the public and the whole community of experts. At the moment, the online informational arrangement only offers a limited form of access with 'deeply buried' description of the certification process when it is not subject to proprietary rules. The rationale for the protocol is not necessarily open to independent expert criticism, the raw data is not available for scrutiny and trying to interpret these would, in any case, require time and specialised knowledge. In conclusion, whatever degree of openness there may be at the moment, it is not readily usable by consumers.

The analysis revealed how misleading certification assurance could be. There were clear discrepancies between experts that were associated to the industry and independent experts. In the sock study, scientists who worked for Sanitized confirmed that their products had been thoroughly evaluated in terms of their impact on health and the environment and links to the certification bodies were indeed available on their website. However, independent studies challenged this assertion in at least two ways. First they

demonstrated that silver nanoparticles were in fact released in the water cycle through repetitive washes, secondly, they highlighted the need to further research the toxicological impact of nanoparticles. Allowing an outright scrutiny of the protocols and results by the entire community would certainly help elaborate more accessible and consistent standard and pick up on verification failures in a more proactive way. This would certainly stimulate the design of better products and exploit technological knowledge in a more sustainable manner.

The role of Experts is not always filled by scientists. This will depend on the information situation being considered. However, the process used to validate information borrows from and diffuses a scientifically-minded approach whereby a concern must be formulated, a suitable protocol must be defined, observations must be made and interpreted.

This interpretation must be both usable and balanced. It must be usable in terms of its relation to the decisions we make concerning the products we buy. But it must also offer a more realistic perspective of the state of knowledge we are at.

The verification mechanism below gives more detail on how the digital label proposes to treat these cognitive requirements.

3. Regulators

As mentioned earlier the role of the regulator or more particularly, the manner in which it manifests may be thoroughly reassessed in a digital setup.

The information system presented here has regulatory properties built into it. The formulation of a *concern* according to an ethical frame of references and the expertise gathered to elaborate a *standard* both support the decision-making processes that regulate the production of goods.

Another important function of the regulator is to ensure that the standard is correctly implemented. The digital label can also extend its functions to assume this role in some instances. This would be the case for product testing carried out by the consumers' community or when a whistleblower's concern is assessed and published through the digital label.

In its current form, the regulator is represented mostly through governmental agencies that have dedicated departments to define standards and to carry out checks. Essentially, these departments are responsible for protecting and promoting public health.

Their structure and mode of functioning are different from one country to another and can be cumbersome and vulnerable to pressure from the industry. In America, regulatory bodies like the FDA are often criticised as industry's marketing facilitator (e.g., Environmental Working Group 2012). In the UK, their integrity appears less compromised. Many initiatives that have

been implemented, such as the public and interactive webcasts of key meetings concerning food policy, demonstrate a commitment towards transparency and an adherence to a public service ethos.

But from a consumer's point of view, these efforts may appear insufficient. By and large, information concerning standards remains difficult to assimilate and the rationale behind some decisions hard to subscribe to at times. For instance, despite a scientific consensus on the deleterious effect of hydrogenated fats, regulators across different regions of the worlds have adopted different rules. In Europe, Denmark became the first country to restrict – rather than eliminate - their use in March 2003, in the U.S., a large selection of food products still contain these fats

Regardless of where they live, consumers may harbour similar concerns toward food safety. When the community of independent experts agrees and provides solid data to support a decision to eliminate a harmful product from the food production cycle, consumers could naturally expect from the regulatory infrastructures that represent their interest - wherever they are located – to consistently act upon the authoritative piece of knowledge that is available to them. Clearly, this is not the case today.

The great variations that exist between regions, in terms of decision and labelling legislation, is a serious deficiency but one that can be addressed by opening up and clarifying the verification process to the public. This sort of

strategic transparency may help diminish the amount of toxic products that plagues today's consumer's market place.

The regulator can also be represented by non-governmental or private initiative. Certifications issued by the Fairtrade foundation or the Cradle-to-Cradle institute both exemplify this regulatory phenomenon. In theory, they are accountable to the public in the same manner the government is. They have an obligation to present the body of expert knowledge they rely on to elaborate the standard they manage.

Finally, the analysis pointed towards the necessity to streamline the elaboration of standards and offer consumers an overall viewpoint on the merits of the product rather than a fragmented one as is the case today.

Managing standards through time requires a continual effort of formulation and verification. This is the role of the chambers to open the elaboration of the standard to the public, oversee regulators and situate their respective contribution with regard to the ethical context of the product life cycle when the standards is created outside the digital label. Chambers also issue calls for verification in order to ensure that external standards follow a suitable protocol.

The digital label dictionary records the evolution of these standards and relates - tags - them to individual values. In that manner, consumers can explore the definition of standards, their state of elaboration and, from there, literally subscribe to them. In practical terms, the set of subscription they opt

for creates a shopping list filter. Consumers can also participate to debates that take place in the chambers.

Figure 13 below summarises these transactions.

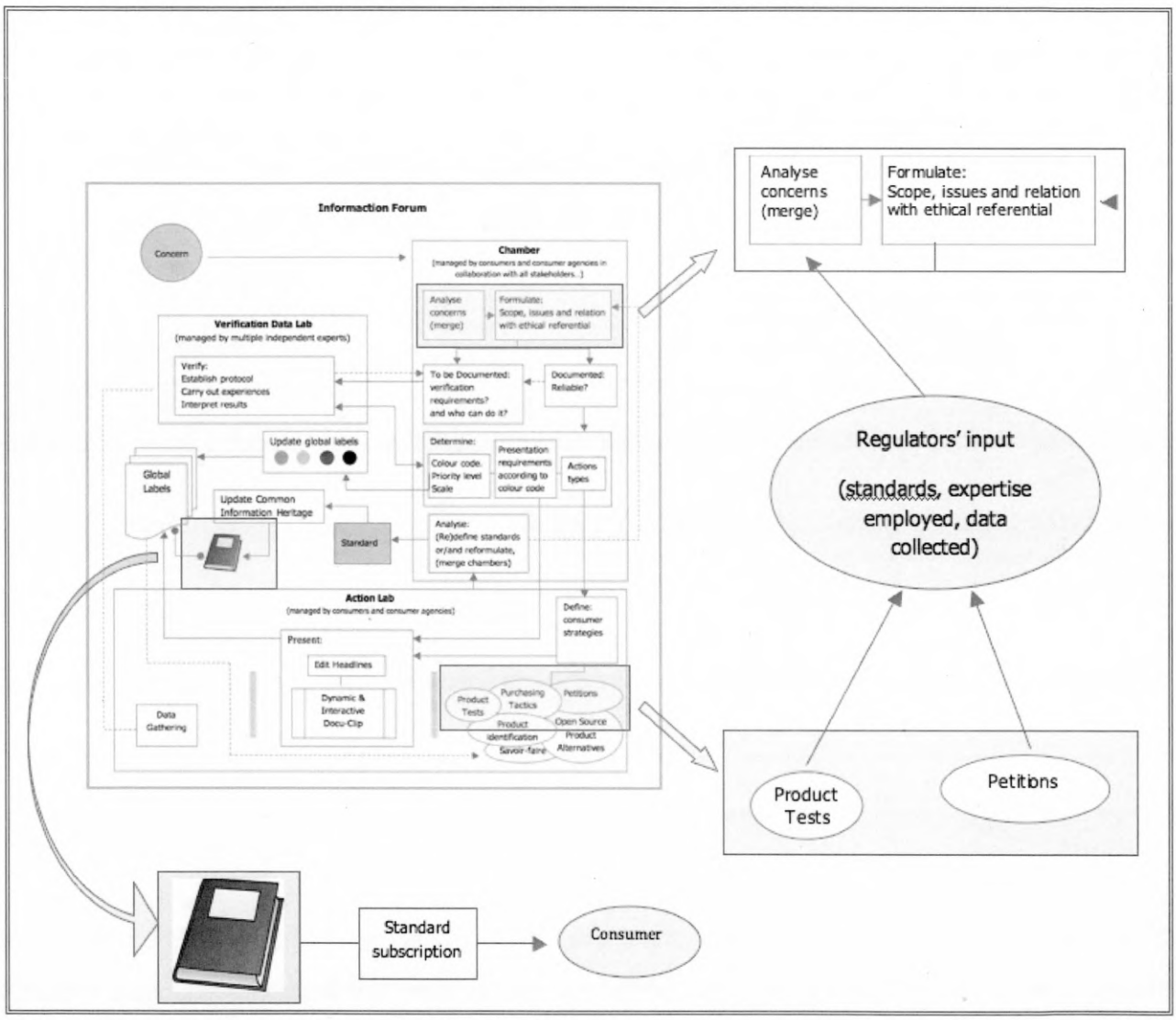

Figure 13 - Role of the regulator within the informaction forum.

4. Producers

Production practices could also very well be reshaped by the multitude of disruptive communicative and engineering technologies that are rapidly emerging. Futuristic scenarios where individuals would have their personal home nanotech 3D printer, a palette of matter and online access to the open source blueprints of highly ingenious products no longer seems far-fetched. The realisation of this vision depends almost exclusively on our conception of the public sphere and the information arrangements we will design to produce and diffuse knowledge, serve the public and serve consumers.

But for the moment the producer often remain a discrete entity with a distinct structure which role is to provide solutions or propositions to use resources in an optimum manner in order to satisfy needs consumers may have.

As previously argued, consumers require, a comprehensive overview of the product they have an interest for in order to carry out a proper assessment. Just like the regulators, producers are accountable to the public and make themselves increasingly available to answer queries from customers. Customer Services have assumed a more prominent role in the last few years, especially in big corporations where they can become a quite sophisticated machinery. However, in its current configuration and as argued earlier, it is not particularly efficient at fulfilling its office. There are two main

reasons for this. Firstly, it takes a significant amount of time and efforts on the part of customers to formulate a pertinent query and contact companies. Also, customer service personnel may answer numerous times the same query. The carefully crafted answers memorised by the staff may lack depth and consistency and not take into consideration more pertinent arguments.

The physical label is limited and does not allow producers to provide all the information consumers may want. This limitation disappears with the digital label and Producers can provide a thorough description of their products, from conceptualisation through to instructions on usage. And allow the description they provide to be opened to scrutiny. They can also manage well-informed queries, sorted through the consumer channels, by answering them once and answering them well.

Producers may want to keep some of their processes opaque and they may have a solid rational to justify their position. It is important for consumers to (1) know that some information is missing (2) be given an explanation for this lack of transparency, in order to see whether they choose to consent to it or not, and (3) have the possibility to understand what the alternatives are. After all, on the web, they are technically speaking only a 'click away' from a more transparent information situation.

Restructuring and opening up information in that manner correct the asymmetry inherent to the physical label and allow actualising one tenet of market principles, the freedom for consumers to choose.

Figure 14 below presents the role of the producer within the *informaction forum*.

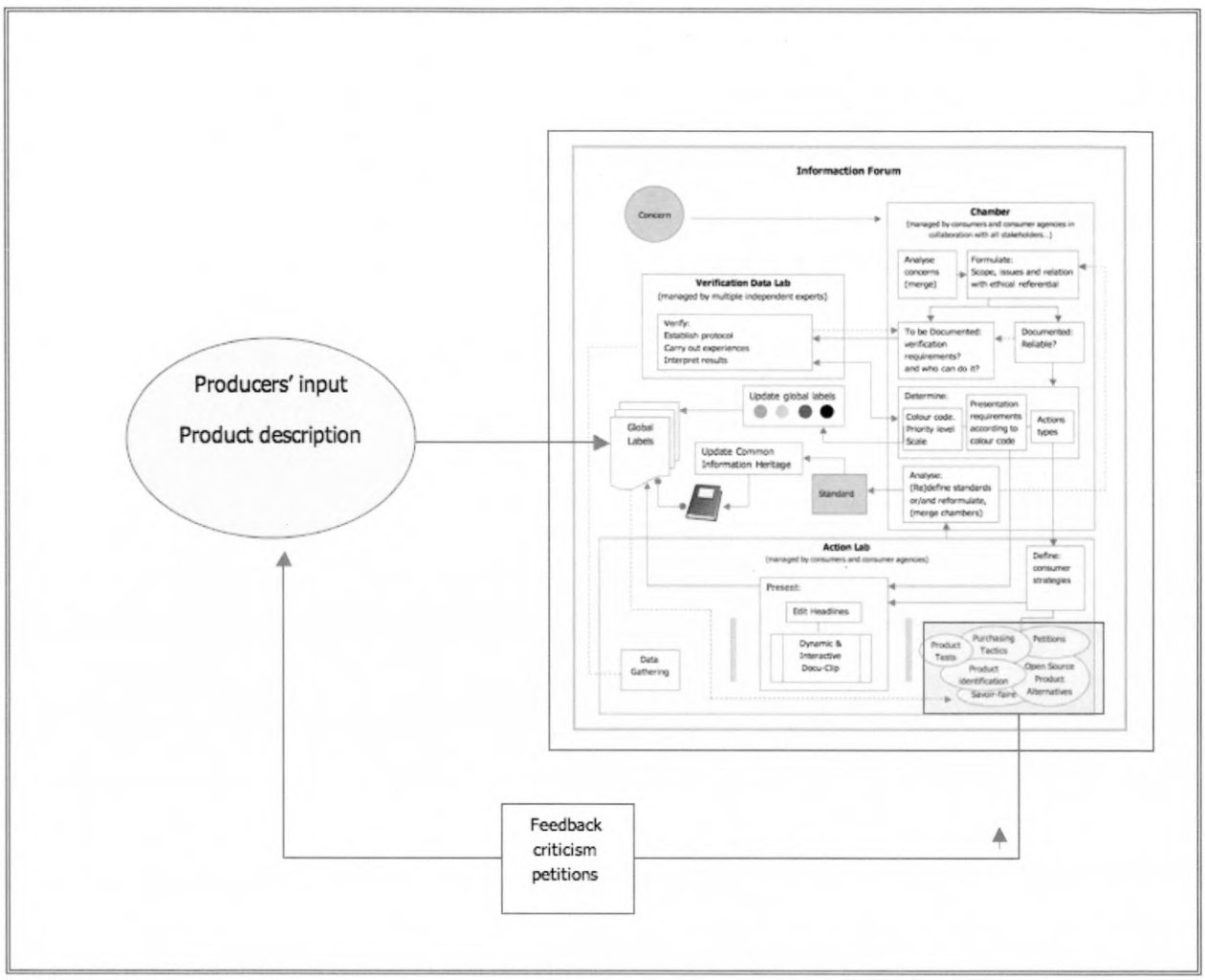

Figure 14 - Role of the producer within the informaction forum.

In conclusion, within the printing model, information is heavily compartmentalised and can be manipulated more easily. In the digital model, this deficit can be reduced and more coherent forms of transaction can take place. Individuals can express their potential and expertise more readily, and the gamut of critical aptitudes necessary to assess the various aspects of the product life cycle can aggregate and be shared amongst all participants more efficiently. Within this collaborative configuration, the capacity to highlight and prioritise significant pieces of information and bring all those who have a stake in the discussion on the same platform can profoundly transform our rapport with public domain information. The timely manner in which the information can be treated and widely distributed means inconsistencies, and in particular the ones that relate to the verification process, can be identified and dealt with more proactively.

MECHANISM OF VERIFICATION

The previous mechanisms have allowed determining what sort of data would be processed in the digital label, and on which collective basis. The verification mechanism delineates a process and interface that offers a rich cognitive environment where the data associated to the concerns consumers may have and registered by the digital label are verified in an open and principled manner.

At the moment the most influential characteristic of the interface between the products we consume and us is largely based on a language of emotions. A great amount of efforts in the marketing industry is dedicated to understand this powerful parameter of the decision making process. Emotions are undoubtedly valuable but without a clear opportunity for consumers to form an educated and skilful relationship with information, these emotions may be readily misguided.

The environment proposed here emphasises the nurturing of critical skills considered essential in the public sphere. This is done by making apparent the nature and principles of a critical assessment and revealing the dynamic character of the state of knowledge - its fallible nature. For this purpose, we must determine the elements of a rich interface capable of promoting such a skilful relationship with information.

The contextual framework attracts different types of informational situations. In order to assess these different situations, different verification approaches may need to be employed. Verifying the net weight of a product is not considered in the same manner than verifying that the product is organic. The *chamber* that treats a *concern* determines the kind of verification process that needs to be employed. This can range from a straightforward data gathering exercise to a complex set of scientific studies that will need to be carried out simultaneously. (see Fig. 11 above).

1. Protocol

   Once a request for verification is initiated, we need to decide what the best method of verification is. The role of the experts is to provide an answer to this question, make this answer open to scrutiny through an independent peer review process, and make the protocol available to the public through the label.

2. Data Gathering

   Once the protocol is established, observations and the data associated to these observations must be gathered and once again must be made available to the public through the label. Members of the various communities of stakeholders can take part to this phase depending on the situation. i.e. verifying the weight can be carried out by consumers while

verifying that a product is organic involves the concerted participation of experts, regulators and producers.

3. Results.

The manner in which results are presented to the public can require a lot of attention. In the past, producers have often dreaded to be misrepresented and for that reason have tried to control, whenever possible, what was divulged on labels. This concern is justified to a certain extent. However, a binary format is often used to present results to the public and this format may not be capable of rendering the complexity of reality and the context of results. A more nuanced format is required to convey the state of our knowledge and its dynamic nature. At its current stage of development, this study posits that three basic cognitive aspects are necessary to foster a more valid form of representation.

- ❖ Understanding what is clearly known
- ❖ Understanding what is questionable
- ❖ Understanding what is not known

This cognitive posture can help consumers form more realistic expectations, and help them make better decisions.

Verification Status

The above-mentioned classification is at the heart of the verification mechanism. The user interface of the digital label will use these three classes of results to organise and navigate through the data derived from the verification process. They offer a very useful perspective on the product we use for the following reasons:

1. Known

This class of results depicts an information situation where the knowledge we obtain from the verification process is clearly established and stable beyond a reasonable doubt.

The advantages of highlighting to the public processes in that manner are significant. It allows ridding the consumption cycle from inconsistencies while promoting good practices.

There is often a lag between the time a fact is clearly established by the community of experts and the moment it reaches consumers. In the study, despite the fact that there has been strong evidence for quite some time now to show that hydrogenation is harmful to health, the practice continues. News worldwide are teeming with scandals exposing toxic products and bad practices which cost to society can be colossal all implications considered. In many instances, the verification data is there for quite some time but remains unpublicised. The Lancet journal (Mullard 2011), refers to Irène Frachon whose research contributed to withdraw the infamous French drug Mediator,

responsible for the death of between 500 and 2000 people, expressed her surprise on the status quo "I hadn't realised that there were so many alarm bells and warnings during all those years".

Likewise, if something is assessed as being good, it should be promoted on the market.

2. Questionable

In many instances, the processes we use are *questionable* in the neutral sense of the term, that it to say, they are open to questions. Different positions are competing and may be valid or it may be acceptable to use them under certain conditions. This category of results probably represents the majority of processes. There are advantages in marking them in that manner. First and foremost perhaps, the realisation that diversity of opinions and practices is a reality and that it is an acceptable state of affair as long as serious inconsistencies have been signposted, and eliminated from the entire production life cycle. This state of knowledge is where the creative and inquisitive nature of the production process mostly lies. It also signals freedom of action from the consumer's point of view.

3. Unknown

Finally, the ability to form realistic expectations also depends on our capacity to acknowledge what we do not know. In the case of the goods we produce, there may be at least two reasons for this deficit. There has been no request to investigate this area of the product life cycle, or the information is intentionally withheld (as a trade secret for instance). In such a case, and as discussed earlier, it is essential for consumers to know that some information is missing and be given an explanation for this lack of transparency, in order to see whether they choose to consent to it or choose to seek an alternative. This would help consumers to move away from a state of blind trust towards a state of enlightened trust.

This taxonomy offers a critical interpretive standpoint and is sufficiently neutral to avoid nurturing misrepresentations. Being able to distinguish between what is known, what is questionable, and what is unknown generate different postures towards information on the part of the label's stakeholders.

The levels of alertness and efforts will necessarily adjust accordingly. Alertness can manifest during the decision making process or in the manner consumers use the product. Producers' incentive to make better product may also be stimulated by this form of open description. Moreover, distributing in a more coherent fashion this classification should help reduce the amount of

harmful processes born from the compartmentalisation of information and the lack of shared perspectives and methods. The fact that the validation sequence is accessible practically but also cognitively is a crucial aspect for the decision making process that is acutely missing in today's informational arrangement.

Today, certifications are unclear, claims from producers are emotionally appealing, but all of these are dissociated from a solid verification process. The distance in time and location from this sort of data is the gap where the development of harmful production practices and dubious marketing strategies can thrive. This distance forces consumers to grant their trust without a valid form of consent.

The product label is an ideal dissemination agent that reduces this distance. What is essential in the mechanism of verification can be described and shared in a timely manner. The digital format allows presenting and exploring verification data in many convenient ways. These representations can play a powerful interpretive role and help situate critical information at a glance.

Visual Representation

The prototype envisages an open and pedagogical strategy where visual representation plays an important role to conveniently situate meaningful events and aggregate quality.

Visual representations can help convey a vast amount of information. The manner in which results are classified can help build informative graphics that can also be used as navigation devices to drill down into the verification data layers. Each process over the whole product life cycle can be colour-coded according to its state of verification.

Figure 15 below presents an interface that uses a preliminary colour-coding system to map the state of verification and conveniently explore all associated data.

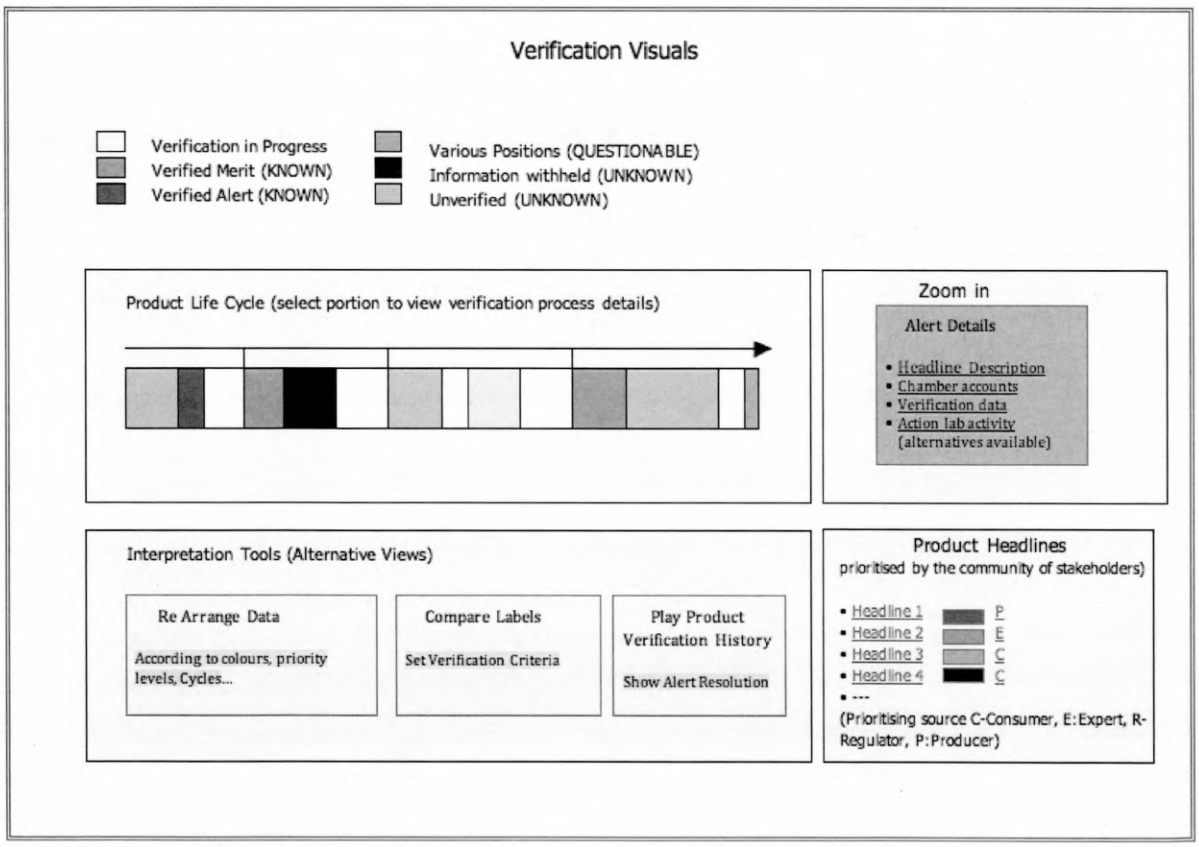

Figure 15 - Verification interface.

Many more intuitive graphics and informative perspective could be derived from a colour-coded interface.

Tagging product in that manner could also help draw comparison between products. For consumer, this means they could be 'one click away' from a 'visually' more meritorious product. The default criteria to carry out the comparison would be aiming at sorting products that tend towards green and orange, while avoiding red, black, grey and white. But users could also customise their query using their own set of criteria. A system of prioritisation of alert channelled mostly by consumers and experts could help distinguish between alerts that can be easily handled and more serious ones. The importance of the issue could also be conveyed by the intensity of the colour In addition, a location parameter could help refine the results for suggested alternatives. The values associated to the set of criteria used for any search algorithm should be at all times explicit and the possibility to further refine the criteria made available to users.

GLOBAL LABEL

The first three mechanisms allow elaborating the Global Label perspective. Each global label gives access to a comprehensive and validated description of a particular product that has been engineered by the four classes of stakeholders. Figure 16 below gives a schematic view of the label's main page.

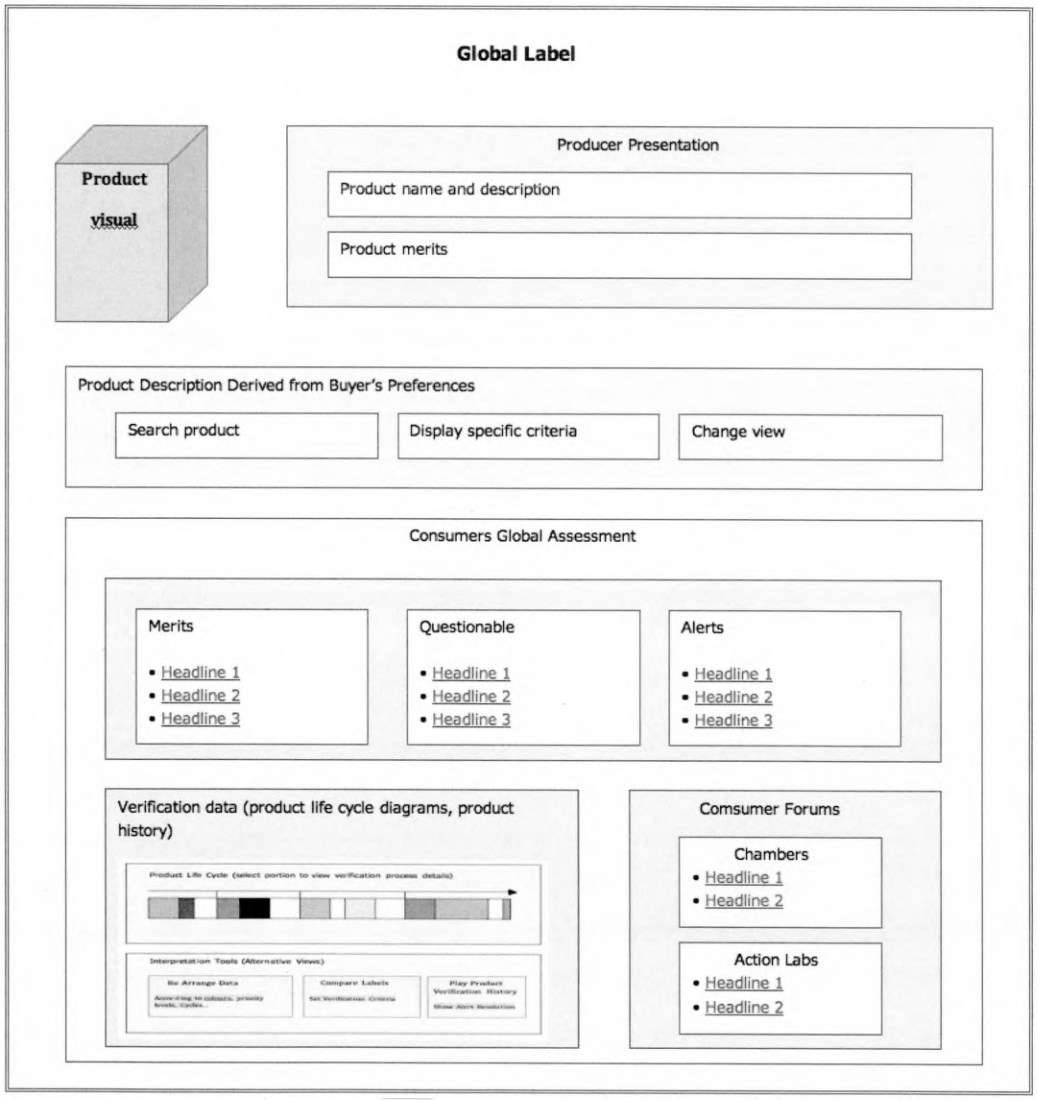

Figure 16 - Global label.

The digital format offers users the possibility to personalise the presentation of the global label in order to make it more relevant. However, the Positioning mechanism, outlined in the next section, can further increase the pertinence of the information provided to users by making it more congruent with their personal requirements.

MECHANISM OF POSITIONING

The first three mechanisms constitute the basis of the digital labelling system and offer a global perspective on consumer products that has been collectively managed. The positioning mechanism is a complementary feature that generates a more personalised view of the digital label (Fig.17). It provides consumers a platform where they can register and update their own values, and thereupon, carry out more refined forms of assessment, and select courses of actions more in line with their own preferences and circumstances.

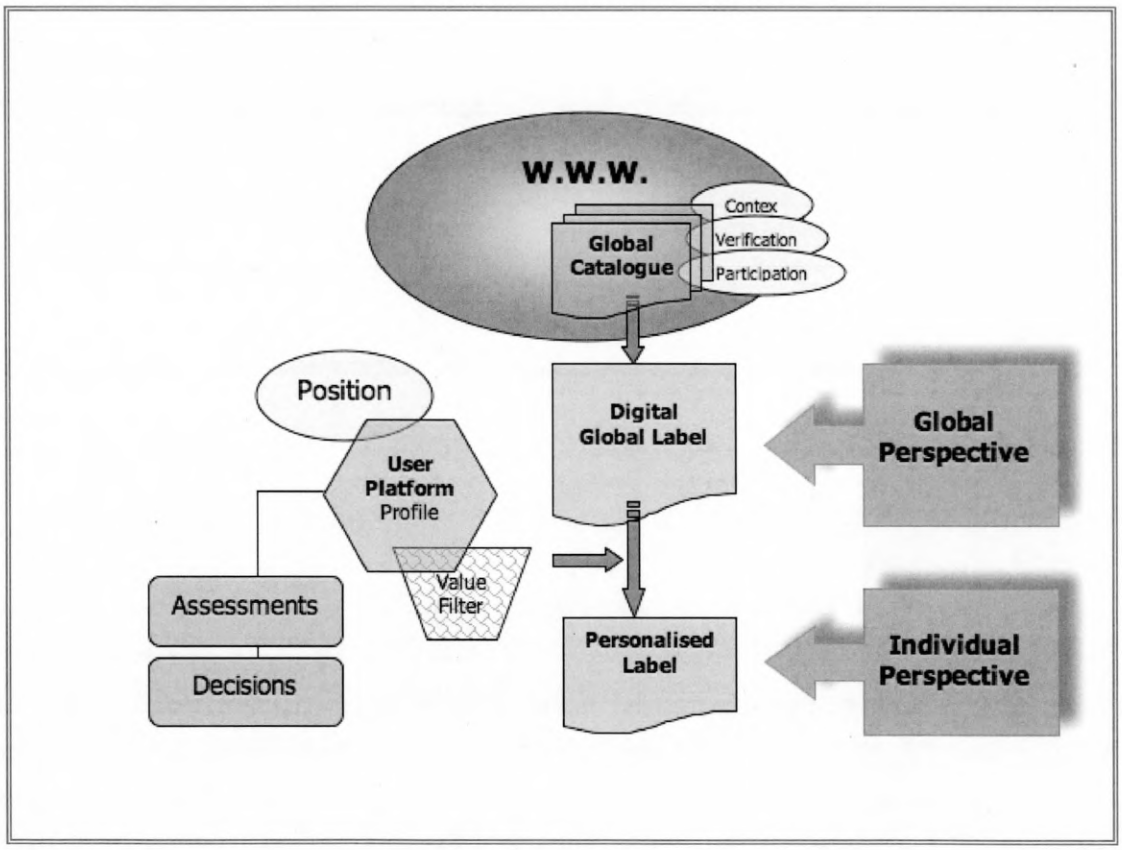

Figure 17 - From a global to a local perspective.

The ability to envisage the complexity of an information situation is one thing. The ability to negotiate it is quite another. In this system, the breadth of this challenge is reduced by allowing users to develop their own profile and by linking it to applications that translate their choices into action. While the global label helps consumers engage with the global significance of a consumer product, the personal platform helps consider its relevance from an individual perspective. More specifically, global labels map global values, whereas the user platform maps individual values. Figure 18 below introduces the basic components of this platform.

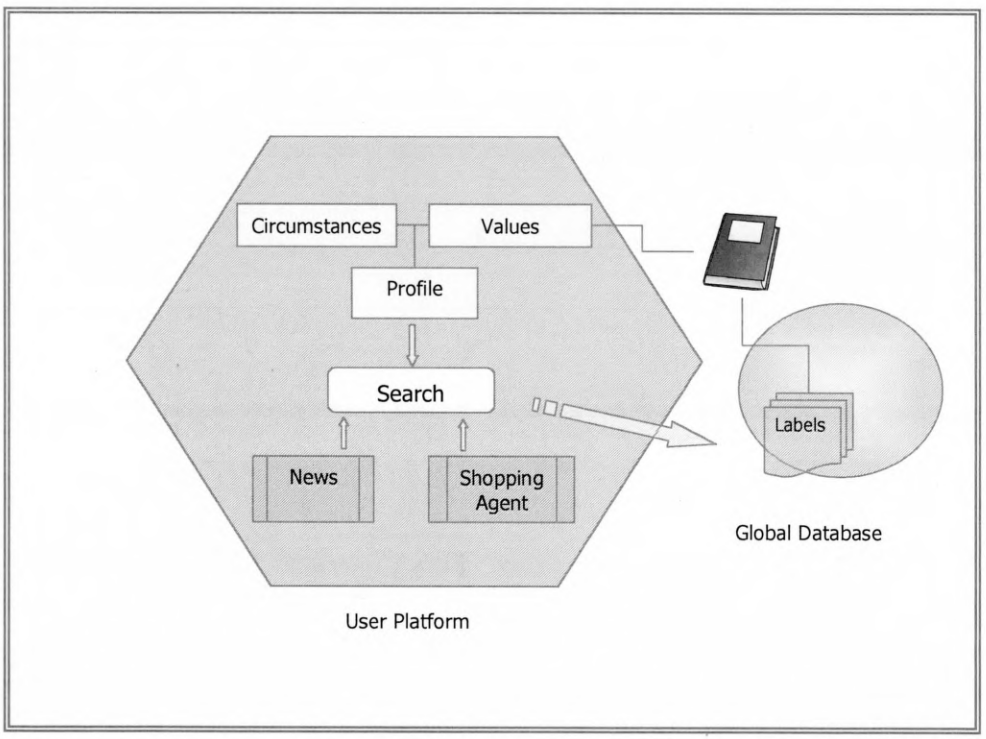

Figure 18 - User platform Components.

Essentially, the user platform allows consumers to map their own values through a profiling system in order to yield more relevant interactions with the catalogue of digital global labels and determine better consumer strategies.

1. Profile

Current search environment are governed by hidden algorithms whose concealed values may not be shared by users and may leave little space for conscious decisions to be made. The *Profile* function of the digital label gives an opportunity for consumers to articulate their own position in terms of values and circumstances. In this manner, consumers reclaim their right to define their own courses of action, while computers processing powers are being assigned the more valid task to determine the optimum solution after having integrated user's acknowledged requirements.

The *Values* component records user's preferences in terms of choices. These choices can be expressed in various ways and put in relation with the rich contextual and verification vocabulary used to describe the processes that have been reviewed in the global label by the community of stakeholders. If necessary, the formulation of these values can be checked against a *dictionary* of consumer values that offers detailed definition that can be shared.

Our choices are also determined by our circumstances. In addition, the profile dashboard allows registering this class of parameters. Three types of circumstances are currently identified on the user platform: *Location, Finance and Health*. The dedicated information systems that manage these sets of data could be put in relation with the digital consumer label system in order to further refine the pertinence of results.

2. Search

Below is a possible sequence of interaction that can be derived from the components that compose the core of the platform.

- A user may register the following sequence of preferences for a particular search or as default criteria for all searches: *"vegetarian, fair trade, and no hydrogenated oils"*
- 'vegetarian' could in the dictionary be defined as: " The practice of following a plant-based diet including fruits, vegetables, cereal grains, nuts, and seeds, with or without dairy products, eggs, or by-products of animal slaughter" (Wikipedia definition) The options "with or without dairy products, eggs, or by-products of animal slaughter" could then be brought to the attention of the user in order to be clarified.

- The "Fairtrade" criteria could be linked to the Fairtrade Certification in order to give consumers access to the principles on which it is established and allow them to form more realistic expectations with regard to this standard. Also, in this case, the fact that certification is granted to composite products (see case study 3) could be highlighted (either by the certification body itself or consumer associations) and open to debate as it can be considered as a questionable position. The possibility to participate to a principled debate with the certification body concerning the level of the eligibility criteria for granting the Fairtrade certification could also be offered at that point. On that occasion, users could also be given the opportunity to register their opinion with the Fairtrade foundation regarding this particular issue making more convenient an informed consumer vote.

- The "without hydrogenated oils" request could be conveniently linked to information regarding the recognised health danger associated with this process. This information could be drilled down to the research data itself. It could trigger a news popup signalling current labelling standards in order to highlight the fact that a certain amount of these oils can be present without having to be labelled and that the replacement process is not yet assessed thoroughly according to some experts. Should the replacement process become independently validated following a protocol of

verification that has been peer reviewed through the system, a notification could be issued making available the array of products that have been vetted.

- Suggestions could be made. For instance (1) search labelled products which manufacturing process for oil is verified thoroughly (2) choose products that do not contain oil but butter. These suggested alternatives could be tactics that have been appraised by the community of experts and consumers. These tactics would undoubtedly evolve in the light of the latest research available to these communities.

- The alternatives suggested would also have taken into account the circumstantial parameters of health, finance and location registered by the user.

- A *Shopping Agent* application linked to the profile could help streamline the shopping activity by helping compose shopping lists and establish the best strategy to acquire goods (from collecting coupons, to calculating optimum delivery itineraries...)

- Finally, circumstances constantly evolve and the record of this change can be provided by the dedicated systems that manage them. Values also evolves throughout a lifetime, but unlike our circumstances they are not sustained by any one particular system of information, but by many, some of which are not necessarily

formalised. The platform could provide a stimulating *News Section* to inform individual values. The recording of values and shopping practices could help elicit a more personalised set of news headlines. A large proportion of news headlines relate to consumer issues, however, it is being distributed indiscriminately to consumers at the moment. A consumer who is vegetarian (and has been able through the digital label to eradicate all meat product from its shopping list), will have no interest in being notified about an outbreak such as the BSE crisis for instance[2]. By contrast, consumers who eat meat need to be informed about alerts and advised on how to best deal with them. Likewise, a consumer who decides to boycott products from a particular origin on political grounds may be interested by facts about changes occurring in this country or company, along with debates and analysis on the subject. Once again a sorting system could help ensure diversity of opinion and quality of information.

- In addition, a *Forum Agent* could help well-informed users negotiate issues and voice their concern more efficiently. As discussed above, a consumer *informaction* forum can help channel concerns

[2] Bovine Spongiform Encephalopathy (BSE), also know as Mad cow disease, is a fatal neurodegenerative disease that has been hypothesized to lead to an ailment known as the variant Creuzfeldt-Jacob disease when human beings eat food contaminated with the brain, spinal cord or digestive tract of infected carcasses. The first case of vCJD was identified in 1986 in the United Kingdom. By October 2009, it had killed 166 people in the United Kingdom and 44 elsewhere. Between 460,000 and 482,000 BSE-infected animals had entered the human food-chain before controls on high-risk offal were introduced in 1989 (Charlet et al. 2012).

in an articulate fashion while avoiding redundancies. These forums could also offer an opportunity to develop powerful tactics to address inconsistencies on the part of Producers or the Regulators thus readjusting constructively the balance of power between the various label stakeholders.

This search sequence illustrates how a digital labelling system based on contextualisation and verification and that includes both global perspective and the explicit formulation of users values could offer a rich and balanced informational environment. In this system, the distance between critical pieces of information is reduced and the possibility to take more wholesome courses of action increased.

The next chapter presents various scenarios that illustrate in greater details the potential of the digital label.

CHAPTER 4 – SCENARIOS

In this chapter, a series of hypothetical situations illustrate the potential of the Consumer Digital Product Label. Interactions in a digital environment can be very dynamic. In each of the situations presented below, a scenario that narrates a sequence of events accompanied by a few diagrams is employed to describe the informational possibilities offered by the architecture.

1. Shopping in a Supermarket

Ella comes into a shop ● Opens her *iConsumerLabel app* on her smart phone ● Earlier in the morning, she gradually recorded an *items-to-buy* voice note that she now opens. A program calculated that this shop was the optimum location for a number of the items that are listed on the note ● She can refer to her *'to-buy' voice note* or interact with all the products that are available in the shop. ● For this particular session, the *buyers circle* includes a *guest profile* that represents two individuals. Kev, a friend who invited her for dinner, and his partner Rhiannon. Ella has already Kev's public consumer profile, but she has not yet

received a response from Rhiannon to share hers ● She knows Rhiannon is allergic to nuts and she can 'drop' this criteria to her profile. ● A colour is attributed to each buyer. Ella's colour is yellow and her guest's is orange ● Ella recently purchased a pair of smart iglasses that allow her to project the screen onto the back of the lenses. ● On the right hand corner of her screen, a bird's-eye view map of the shop indicates where the products Ella wants to buy and most coincide with her values are located (Fig. 19).

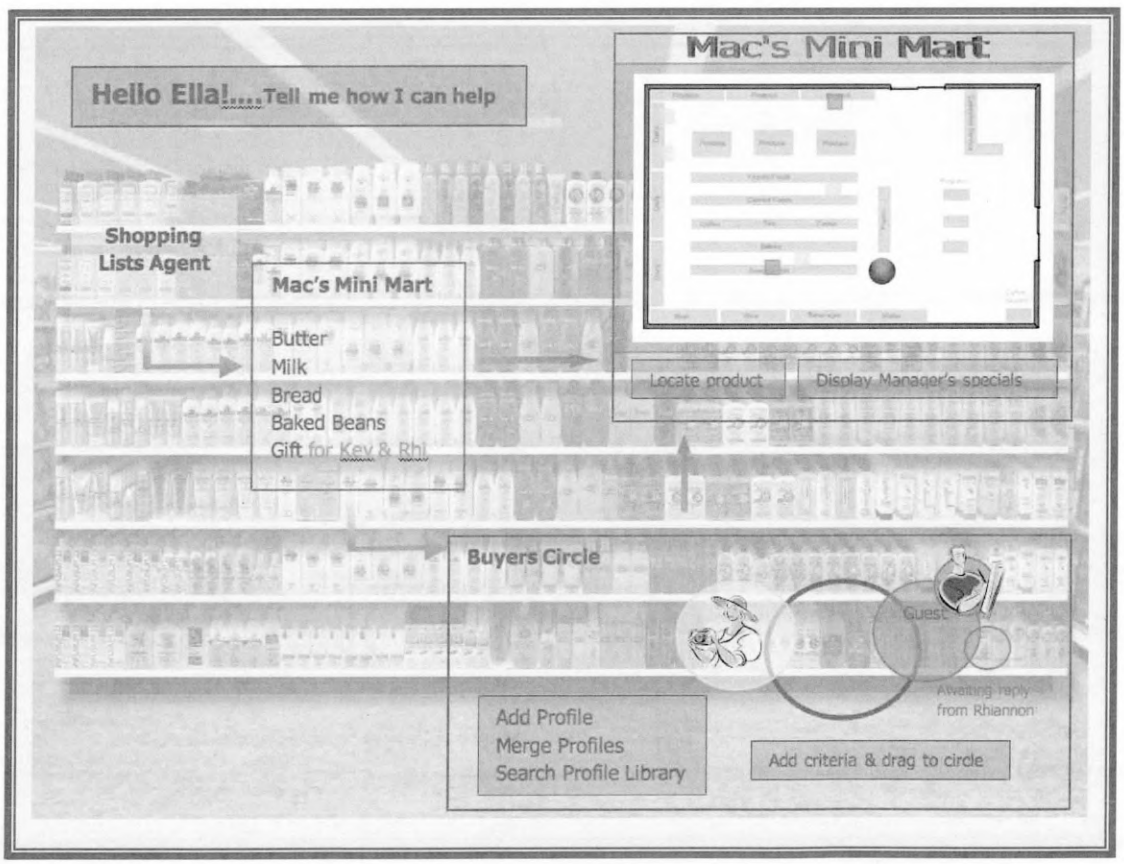

Figure 19 - Scenario 1- view 1.

As she starts to walk down the aisles of the supermarket, the digital labels that have been identified by the *iConsumer Label Agent* get superimposed onto the products they correspond to. ● However, Ella is not very receptive today, and she asked her *agent* to only display the products she is interested in and a couple of today's specials from the manager. She could also have used *a friends or customers recommendations circle* to suggests products. Whichever sources determine the selection, it will, by default, take into consideration her profile and will appear in green. ● As she approaches the dairy section, the milk label stands out from the shelves (Fig. 20). ● The milk is certified according to two of her essential values, *organic* and *free range level 2*, and one negotiable value, *locally produced*. She has recently subscribed to *free range level 2* after participating to an *informaction forum* on this subject. This particular forum led to the creation of a more exigent standard on the treatment of dairy cattle. ● Some of the producers who attended the debate already worked in this manner while others adopted the standard during the discussions. In so doing, they were able to benefit from the experience of the former group. ● They received their certification rapidly after the standard got finalised and allowed a good number of products to become available to consumers. ● This standard upgrade raised the

prices of a number of basic products Ella buys. But, her *budget agent* helped her identify inconsistencies with her expenses and streamline her purchases. She also subscribed to a *voucher cloud* in order to receive discount voucher codes. She can therefore afford this increase. In addition, she could have subscribed to a budget *strategy suggestion* available from that forum in order to sustain her values. ● Ella still receives *news feeds* from this forum as some very interesting arguments were presented in favour of an even more stringent standard. The problem is that this would significantly impact the price. A *brain-storm chamber* has been set-up to address this particular point.

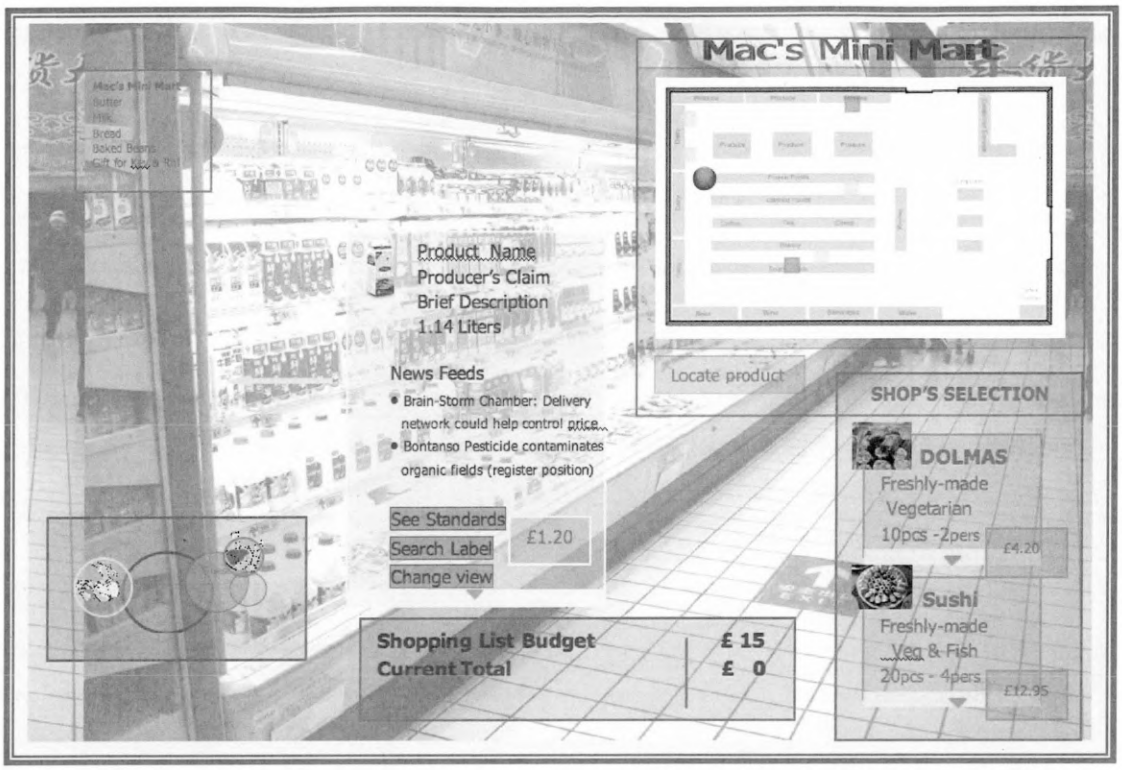

Figure 20 - Scenario 1 - view 2

Ella picks up some eggs, the next item on her list. The standards she uses for the milk applies by default here as well. The egg label informs her that the negotiable requirement concerning 'local products' has been met on that occasion.

Ella is now walking towards the canned food section to get a few tins of baked beans. Ella had stopped buying this product after finding out through a *docu-alert* that most brands added High-Fructose Corn Syrup (H.F.C.S.) to their product. ●

Ella tolerates a range of non-organic foods on her shopping list in order to stay within budget and only applies the organic standard to the products she consumes on a regular basis, or products otherwise identified as containing the highest amount of pesticides. She subscribed to this *strategy* after her *budget agent* highlighted to her an increase in her food expenses. ● After the diffusion through the digital label of the H.F.C.S. *docu-alert* supported by various groups of independent scientists that clearly documented the detrimental impact on health of this particular sugar, an effective consumer-led campaign took place. ● Despite the various names under which the culprit sugar was known across the world, the *IConsumer label* helped consumers from various countries identify the products that contained it and those that may contain it in places where the legislation was not clear or the producers did not cooperate. An important amount of petitions were sent to regulators and producers and a great deal of strategies were devised and shared through the various *action-labs* of the forum set up to deal with this issue. ● As a result, a significant number of companies eliminated this type of processed sugar from their product and replaced it by sugars that had no known issues associated to them. In fact, some companies took this opportunity to modify their recipes in order to diminish the amount of sugar and salt they contained while preserving an attractive taste and were able to raise their score on the *global label.* ● This forum also led to the creation of a *brain-storm chamber* concerning "sugars in consumer products" which objective

is to evaluate the perspectives and data that will need to be taken into account to deal with this broader issue. Ella has on occasions taken part in *action-labs*, in particular those that concerned animal welfare, but, she is rarely interested in the debates that take place in the chambers. However, her grandmother, who is a nutritionist, follows the discussion with great interest and has recently assumed a more participative role in the 'sugar' chamber. She will probably receive a message from her if something worthwhile happens in this respect, although her *iConsumer app* will also be able to identify previous concerns from her record and suggest news headlines that relate to this issue.

Ella has the choice between a couple of brands. The cheapest one is not as verified as the more expensive one. In fact, a great deal of information is missing from the product life cycle when she enlarges the verification window. ● At the same time, she finds the sushi platter the shop suggested quite attractive although quite expensive, more expensive than what she had thought of spending on a gift for her friends. But she would like to bring the platter to Kev's party anyway as a contribution to the meal. ● She now transfers to her smart phone and drags with her fingers the two labels suggested as gifts and highlighted in orange on her map in the middle of the screen to compare them with the sushi rolls. She likes the idea of the platter better. The platter matches her profile, but she needs to check if it matches Kev and Rhiannon's circle. She drags the label onto their circle. Some sushi rolls contain sesame seeds and an

alert pops-up to indicate that it may not be a suitable as it may cause an allergic reaction to Rhiannon. ● However, Rhiannon's has just sent her profile, which updates the system. It clears the alert and replaces it by a warning. Rhiannon does not eat fish and will only be able to eat some of the sushi rolls on the platter. ● Ella decides to buy the platter and also decides to buy the cheaper brand of tomato baked beans to make up for the increase on her initial budget. She moves the sushi label onto the *locate product* button to situate it on the map, and into her shopping list which confirms to her that she is now above her budget. Her shopping list 'reminds' her that she still needs to buy the bread and the eggs.

Few days later, an alert pops-up on Ella's app to inform her that the tins of baked beans she bought belongs to a batch that could be contaminated with a high level of bisphenol[3]. She is given advise on how to deal with the alert and a list of outlets where she can bring back the goods and get reimbursed. She can also participate to the action lab that assess this particular event, or navigate to the larger forum that manages the question of canned food contamination.

[3] Bisphenol is an organic compound used along with other material to make plastics. Its presence in consumer products and foods contained in such product is causing concerns. Bisphenol is a hormone disruptor that accumulates in the body and that has been linked to deleterious health effects. In September 2010, Canada became the first country to declare Bisphenol a toxic substance.

2. Querying the Digital Life Cycle

Lily has decided to buy some tanalised wood for an outdoor structure she is intending to build in her garden ● She was aware through the digital label of the issues associated with tanalised wood when she bought the posts. Initially, she had planned to use some of the wood for a vegetable patch, but the information concerning the issues relating to this type of processed wood dissuaded her to do so. ● She only bought a certain amount of wood, just enough to start with her project and placed the rest of the wood she needs to acquire on a *shopping list* with a deadline of two months. Her *iConsumerLabel app* will notify her if or when a more sustainable and financially suitable alternative has become available within this period of time ● For the time being, she needs to understand how to handle correctly the tanalised wood she bought. She selects from the life cycle timeline the section that corresponds to her informational needs ● An interactive *docu-clip* opens. Alternatively, she could also have selected a textual version or the beta version of the very intuitive hologram adviser app that can demonstrate how to use the product and can also answer her queries as a professional would. She is strongly recommended to use protection and given advice on how to prime the wood, cut, and dispose of it so as to minimise health and environmental impact ● Due to consumer pressures channelled though the iConsumerLabel, the DIY shop that sold her this product is now proposing to

dispose safely of the wood cuts she is not using. In some areas, the company relies on local collection service that specialises in the recycling of hazardous materials. A video segment update has been added to the main *docu-clip* timeline to inform her that this service is now available in her area. She can explore in more detail this segment and directly opt in for the scheme from there.

● Several groups of scientists have merged to evaluate soil contamination with arsenic compounds and heavy metals. *Blind requests* have been sent to consumers who bought tanalised products. The request indicate a maximum net participation of 8 minutes to take part to this data gathering activity once individuals receive the test kit.

3. Querying the Verification Data

Suki underwent surgery on her elbow six months ago. It took a while for her wound to close after surgery. Furthermore, her scar is not healing properly. Her doctor has diagnosed the formation of a keloid (a heaped-up scar that rises quite abruptly above the rest of the skin and is the result of an overgrowth of granulation tissues). She would like to know what sort of treatment is available to eliminate or reduce the appearance of the scar. She searches the database and explores the verification layer in order to compare the merits of several products.

By entering a brief description of her condition, she is able to review which clinical protocols most correspond to her specific case. The suggested list of products that is suggested to her also takes into consideration Suki's values when relevant. There is also information from the global forums associated to the products she is reviewing. In this case, a warning on animal testing is accompanying one label. The warning leads to a debate chamber and actions labs. She can see that many of her friends have subscribed to this informaction forum.

4. Managing Values Through Time

Dewei is now reading the news. His i*ConsumerLabel* news widget displays a personalised set of headlines he can conveniently review in more details (Fig.20) .● This set has been compiled with relation to his profile in terms of values, circumstances, shopping lists analysis and participation to the *informaction forums*. Another set of headlines shows headlines that have been prioritised by the community of consumers at different scales (international, national, regional, circles of people he trusts) ● He can adjust how his headlines are displayed. At

present, the default settings proposes three main categories, *alerts*, *advances* and *debates*. Dewei chose to view only the first two items in each category (Fig.21). Today's headlines are as follows:

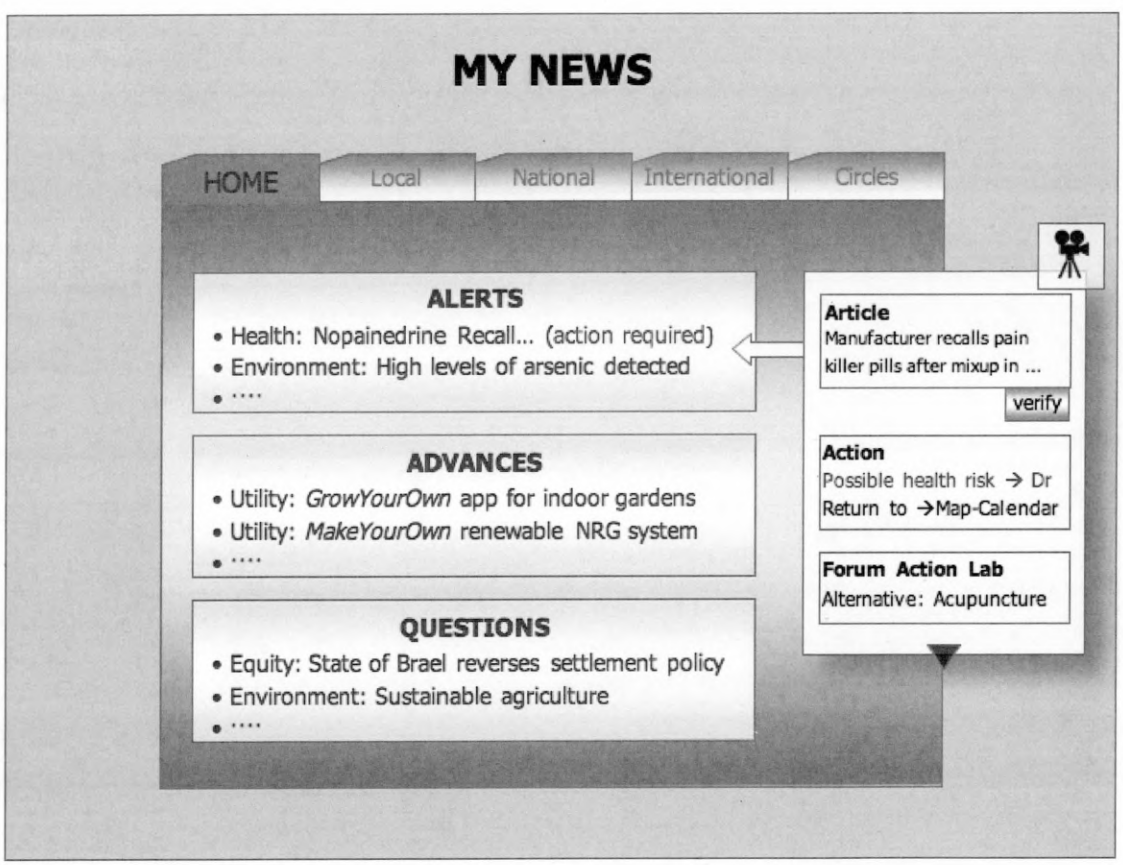

Figure 21 - Scenario 4.

Alerts

There are two classes of alerts. Those that directly concern Dewei and require immediate action and those that have been flagged as high priorities at the global level and relate to Dewei's interests. Each news item is linked to a set of accessible verification data, debate forums and courses of action.

Health: Nopainedrine Pills Recall due to Manufacturing Issues

In this case, the alert has been triggered by Dewei's shopping list. Dewei has recently bought some pain relief pills. The company that manufactures them has issued a voluntary recall for 1645 lots of four products, amongst which the Nopaindrine. The director of the FRA (Federal Regulator Agency)'s office of antiviral products explained there was a potential for a product mix-up with prescription painkillers. In some cases, the new composition can lead to serious conditions depending on the medical record. Dewei's medical record highlights the need to consult his Doctor ● Drinking water is being closely monitored in Dewei's area. The advise given to dispose of the drug takes into account the efforts being made to reduce the high levels of PPCP's (Pharmaceuticals and Personal Care products) that have been detected in Dewei's area. Discussions in the alternative labs have also connected the concern to different verified approaches for the treatment of pain. Dewei explores the links that document acupuncture.

Another news item attracts his attention.

Equity, State of Brael reverses settlement policy

Dewei has been boycotting products from the State of Brael for the last few years. Since then, any new developments and analysis that deal with the issue that concerns him are brought to his attention. These articles come from various authoritative sources and represent a diversity of opinions. He may decide on this occasion to remove the filter from his shopping list that prevented products (including complex products) which origin or processes could be traced to Brael.

Possible Future Impact

The iConsumer app is allowing various equitable and eco-conscious economic models to gain popularity since its inception a decade ago. It is proving a valuable source of information for both consumers and producers. Product specifications that better reflect socio ethical concerns and consumers' expectations can be more readily derived from analysing the critical evaluation of consumer products.

Complex products that require a sophisticated infrastructure to be manufactured are still developed in factories. Their life cycle is becoming always more consistent thanks to the widespread adoption of Cradle-to-Cradle type methodologies and the unabated and widespread scrutiny of the public.

Not only products have become safer, more socially and environmentally sustainable, they have become also more usable and aesthetical pleasing.

Inconsistent practices such as scheduled obsolescence have now been almost eradicated. Many of the products that are manufactured with raw materials which cost to extract are now leased rather than sold to consumers. In this manner, the manufacturer can up-cycle materials and update products.

But the digital label is also helping channel the development of other forms of services and products. Concerns that have been treated in the Informaction forums have allowed defining needs consumers may have and determine possible answers to these needs. These exchanges have in many cases led to the constitution of a database of open source products which blueprints can be downloaded from the WWW. Personal 3-D printers with integrated material up-recycling units can now allow consumers to manufacture some of these products from the comfort of their home. Consumers are becoming autonomous citizens.

CHAPTER 5 – RESULTS AND DISCUSSION

In the first part of this chapter, the results of the study are presented. Visual representations of various aspects of the architecture and the different scenario introduced earlier are discussed in the subsequent section. Further potentials of the architecture not mentioned to that point are then discussed, along with the extent to which the current climate favours future developments. The chapter ends with a discussion on the premises concerning communication, which have driven the elaboration of the digital label.

Results

As a reminder, the aim of this research, detailed earlier, was primarily to understand and improve the conditions of our relationship with information in critical areas of the public sphere by considering the forces that influence the treatment of information in those situations and the potential that new communication technologies offer to organise information in more effective ways. Specifically, this study sought to find a valid conceptual framework that could better support the development of digital public information systems, in the critical case of consumer products.

The literature review pointed to deficiencies of the state-of-the-art in the field, and to research challenges in terms of conceptualisation of the subject under consideration. These deficiencies are linked to the fact that a large number of studies appear to be poorly designed and lack the ability, in many cases, to take into account the complexity of the subject or to capture the cognitive dimension of our relationship with information systems. Also, the emerging digital initiatives reviewed take advantage of locative technology but not necessarily from the perspective of a deeper reflection on how information can be structured more efficiently using the digital model.

The results obtained in this study acknowledge the organising potential of the digital model in establishing more coherent relationships between clusters of information that were compartmentalised until now. Informational arrangements of that type can radically transform our consumerist culture. For instance the gap between the informational cluster that pertains to the protocol used to conduct expert studies and the cluster that defines consumers' purchase decisions can be significantly reduced in the new communication model. This gap is currently vast and allows toxic products to flood consumer markets. The configuration proposed in this thesis places consumers in an optimal position to make decisions by highlighting the most significant argument of a public debate.

The study also formulates a proposition to consider information arrangements in the public sphere as an opportunity to engage and develop our cognitive potential as individuals and as societies. This cognitive potential manifests in the proposed arrangement essentially through the ethical referential

component of the contextualisation mechanism and the engaging relationship with the verification process. The manner in which information is organised on the user platform also involves the development of our intellectual abilities by acknowledging that the development and expression of our values require a dedicated and stimulating knowledge environment that can also acknowledge individual circumstances of users. For this reason, the results presented here consist of an architecture that is in essence a digital deliberation platform for public debate.

First level of result

The four mechanisms are to be considered as one level of result. They can each be developed independently, and as a whole, contribute to foster the development of public information systems.

The digital labelling system proposed in this study is essentially a conceptualising exercise. The intention of the research was to demonstrate the potential of an information arrangement based on contextualisation, participation, verification, and positioning.

This architecture appears capable of delivering a valid, quality filter for the nurturing of a more wholesome and mature public information system. It has brought a possible response to the issues that had been identified during the literature review and the analysis of current labels. Thus, within a digital interface of a product label:

- ❖ Information can be made more complete and easier to understand.
- ❖ The vast amount of data available online can be organised in order to create a rich and coherent informational environment.
- ❖ Tools can be created to help translate information into more consistent forms of actions for consumers.

Second level of result

A second level of result is offered through the diagrams and in particular the "informaction forum" (Fig. 11). Combined, these diagrams can serve as a high-level blueprint on which to base the development of a more practical prototyping program, a little bit like the flowcharts or pseudocodes used by programmers as an initial step in the development of computer programs. When it is put together, a full-fledged prototype will help confirm the practical relevance of this informational arrangement. The chapter on Future Prospects below discusses the next step in the development of the Digital Consumer Label. Once the label has reached this stage and opens up to criticisms, other components may assume significance. But the core principles of this four-tiered architecture, and the manner in which they work jointly and exercise influence on each other, should be preserved to fully realise the original design objectives and preserve the balance of power that appears essential to the production of information quality.

Third level of result

A third level of result is the descriptive character of the model proposed here and the fact that the architecture could be used as a basis to describe and situate current developments (such as the ones that have been briefly reviewed in the literature review). It appears to offer a solid foundation to catalogue, compare and analyse them critically.

As detailed as they may be, these results of the above conceptual analysis are still preliminary at this stage. It is clear that to confirm the usefulness of the proposed architecture, and eventually its contributions to the flow of information in society, a prototype of the architecture needs to be implemented and tested. Only at that point, with a working prototype that consumers will be able to test drive, will it be possible to ascertain definitely and rigorously the soundness of the conceptual analysis presented here. Nevertheless, a first step in this direction will be attempted in the following section, dealing with a critique of the visuals that have been presented in this study and the analysis of scenarios.

Visualisations and Analysis of Scenarios

The digital labelling system proposed in this study is a preliminary step to a prototyping phase. At this stage of development, most screen views for the system interface are coarse representations. They serve the purpose of delineating key modes of interactions with the database and could be improved.

For instance, more powerful graphic solutions could be found for the colour-coded transcription of the verification results. This visual needs to instantaneously inform consumers on the state of verifiability of the information they are interested in by reference to a system of values and parameters that includes both a global and individual perspective when the user profile is factored in. These are delicate notions to convey in their entirety and require a crafty design. Input from the fields of cognitive visualisation would certainly helps strengthen the overall usability of the database from functionality to appearance.

Also, the scenarios given in the previous chapter only served to illustrate some of the most obvious interactions that can be generated by the database and its interface. These schematic views do not give an exhaustive account of all the types of instances that can be derived from this very versatile system, some of which are introduced in the next section below.

There are a few remarks that can be made about this versatility and how this could engage user's experience.

The digital representation of product labels offers a constantly updated collective assessment and, when requested, personalised arrangement of the information that pertain to the product being described. This description reflects the inherent dynamic character of the product life cycle, the constantly evolving body of knowledge that surrounds and govern the products we use, and the particular informational requirement of each user. Each of these domains of information is, by nature, dynamic. This means that a particular digital product

label will constantly morph according to users as well as over time. The fact that users will not necessarily obtain the same screen view of the label at any given point in time is not an inconsistency but the result of the input of the parameters that describe the user's values and personal circumstances. The personalised digital label will nevertheless retain elements of the global assessment in its composition that have been deemed as significant to all users. This helps maintain the balance between two informational imperatives: the global perspective which the collective assessment produces, and a more local perspective generated by the values that characterises individuals.

These two perspectives may each vary in scale. The global perspective, according to the information treated, may stretch from internationally-based to regionally-based data, while the local perspective can include several individuals from a same group - a family for instance. In such cases, users must be able to get a sense of the scales they are dealing with and have the possibility to change scale easily. In the case of the global perspectives, this can be conveyed by the use of circles maps that would associate a set of information to its geographical location. In the case of the local perspective, the user account could be managed by one individual but represent the interests of, and accessed by several individuals. This would require users to determine what are common circumstances (e.g. in the case of a family this may be finances, location, religious values) and what are individual circumstances (e.g. health, political views, or again religious values). Again a mapping system (or circles as was suggested in scenario 1) could be used to navigate through the various scales.

Further Potential of the Model

There are many more ways in which the system can be exploited that have not been depicted in the implementation section. For instance, data that could be extracted and analysed by scientists or economists through real-time smart surveys, can be supported by the system.

The database could also branch out onto a more educational informational circuit. The knowledge, which contributes to the elaboration of the product we use, has, at one point, a natural bond with the educational sphere. Today this relationship is distant and abstract due to the manner in which we have compartmentalised knowledge under the pressure of sociological and technological constraints. Only a minority of individuals have an opportunity to engage intellectually with the close link between the maths, the engineering and the aesthetic tucked within the fabric of the products we use. This link creates an edifying picture and could be made more tangible, more instantaneous and be better distributed within society. The products we use everyday are an ideal platform from where to explore academic disciplines, to appreciate the connection between knowledge and its applications, and to develop a heightened sense of appreciation.

Another application the scenarios have not highlighted relates to the data extracted from the verification layer. This data could be associated to a class of tags that helps determine different stages of reasoning. This classification could subsequently be used to generate rich-content *verification documentaries* that

are highly interactive and could be tailored to respond to the cognitive abilities of individual users.

In addition, an advertisement layer could be integrated to the digital label. Considering this aspect may help incorporate questions of economics. Within the digital product label system, advertisements would be vetted by the validation mechanism and its ranking made to respond to consumers' informed and expressed individual values. This situation would contrast with the concealed and obscure algorithmic logics that currently determine how ads are ranked and targeted to users. This latter approach undoubtedly narrows the meaning of what may be 'relevant' to users. A well-established algorithm such as Google AdWords does not include any variable that appraise the merits of the products that is advertised to consumers, nor does it factor in the values those consumers could aspire to cultivate. Only those habitual and often manufactured expressions are retained and fostered.

Finally, the architecture, provided a few amendments to its contextual framework, seems capable of treating other information situations. Services, for instances, could be validated through the digital label. Other more abstract information situations may also be good candidate for a validation process of the kind suggested here. These certainly ought to be researched.

The various informational experiences that can be derived from the digital consumer label demonstrate how product label can become much more than a mere descriptive device. A digital consumer label can become a portal towards a

more consistent and mature public information heritage that integrate key domains of information and a platform for citizens to negotiate values in a more articulate and perhaps, in more authentic and constructive political manner.

Favourable Circumstances and Current Developments

The current climate also favours the development of this cast of public information system. The architecture responds to the demand from the public for an ethical referential and more information transparency. A great amount of data is available but needs to be organised to allow meaningful interactions to occur. The contextual arrangement allows to capture in an open and principled manner the whole array of data susceptible to interest consumers. The other mechanisms allow to bring to the fore what may deserve the attention of users, by prioritising, verifying and personalising product information.

During the course of this research, several digital label initiatives that aim at providing more information have emerged. These products are designed to provide consumers with this information right at the point of sale, to help them to apply their values to their purchases. In that sense, the architecture presented here offers a comprehensive and workable description of what a digital environment can offer but, as also argued earlier in the 'Result' section, it seems to go beyond.

The four mechanisms that articulate the proposed labelling system delve deeper into the potential of a digital environment:

Contextualisation: The ethical referential used to assess the merits of consumer products is wider. In addition to the health, environment and social criteria, the referential offers the possibility to discuss the merits of the product itself, in terms of its utility and design. It also provides the possibility to constantly redefine and refine standards.

Verification: This mechanism proposes tools to interpret the status of knowledge from the very beginning of the verification process, that is to say from the moment a protocol needs to be established. Transparency at that point is essential and would allow addressing many of the issues that currently affect the credibility of the validation process. In 2009, testing of a popular toy carried out by GoodGuide triggered a momentary safety scare. GoodGuide testing method differed from the one established by the regulator, and discovered the product contained a higher than accepted level of antimony, a metal that can cause cancer, lung, and heart problems (Palmery 2009). Being able to investigate the rationale behind the validation process is a key informational step and one that should be made conveniently accessible to consumers.

Participation: The proposed architecture grants a greater role to consumers and experts. The treatment of information is considered from the perspective of consumers and largely initiated by them (through concerns to standards). This change of perspective may significantly affect the manner in

which discussions around the product life cycle are conducted and how key pieces of information are prioritised. Information is validated through a transparent and principled process of verification led by experts and in collaboration with regulators and producers who become more accountable. Within this configuration, many more economic models of production are possible, traditional methods of production as well as more innovative methods where collaborative logics (e.g. open source products) could assume a greater role in the future.

Positioning: The positioning mechanism provides a more complete informational landscape where values are considered with respect to their dynamic nature. For that reason, values will require a dedicated informational system that can relate to the courses of action and decisions we take as consumers. Ideally, this system should offer diversity of opinions and the possibility for consumers to participate to a more elevated public debate. In that sense the label becomes a democratic platform where consumers are encouraged to engage as active citizens and equipped to negotiate the evolution of consumer products.

But this openness may be met with reluctance by those who have vested interests in keeping things the way they are.

One apparent difficulty in the implementation of the digital label may come from an over-active legal apparatus that represents the interests of powerful producers. Until now, this sophisticated machinery has been very effective at

controlling the information that can be disclosed to the public or the information that is hidden from the public depending on how we decide to describe this type of intervention. But the public is becoming increasingly aware of this information blackout and critical of it. News media, *viral* documentaries like Food Inc for instance (Kenner 2008), effectively contribute to raise awareness of such practices.

The rationale behind these information concealment practices often brings to the fore the argument that the public lacks critical interpretive skills, and for that reason, may be prone to irrational panics. This may be so to some extent, and educational analysts in the last few years have repeatedly commented on the failure of schools and universities to develop satisfactory aptitudes in this respect (e.g., Bok 2008). However, this line of argument has inherent weaknesses. In particular, there is an unavoidable conflict of interest if producers are in charge of controlling the communication regarding the risk associated with the technologies they exploit.

A less problematic course of action would consist in developing tools to help consumers interpret information and let them establish their own approach towards risks, an approach that will most certainly evolve to adapt. Furthermore, by addressing the concerns that may arise, the opportunity is given for all stakeholders to distinguish between what is, to the best of our common knowledge, clearly a threat, what is clearly not a threat, and what is questionable. From there, individuals are equipped and can reclaim the degrees of freedom to deal with the "questionable' from a position of awareness and consent. The

inability to distinguish between these three situations, which suppressing the information to public scrutiny necessarily leads to, is unjustified in today's technological context, and can be harmful. It can also open the way to a whole new range of difficulties, amongst which, the lack of incentive to create and promote more socially wholesome and technologically ingenuous products.

The digital label is, primarily, a forum that allows appraising the merits of the product from a consumer perspective. But it is ultimately in the interest of producers to allow this debate to take place and deal with concerns in a proactive and open manner. The balanced and nuanced environment offered by the label, the outright recognition that products are complex and some processes are 'questionable', the convenient and common access to verification data, the possibility to directly handle conflict in a discursive and constructive manner are assets and not liabilities. A lot of resources are spent in treating concerns, reassuring consumers, and too often, this energy is spent on maintaining inconsistencies that in the end damage the trust that lies between consumers and producers. All things considered, it may make more sense and be in fact more *profitable* to produce goods that have been well-designed in every respects and. This posture is gaining weight and enlisting eloquent adepts. Sustainable Design Methodologies such as *Cradle to Cradle* (2002) fathered by William McDonough and Michael Braungart are proving perfectly viable. This wise creative energy that may have once been deemed as utopian seems to make sense and find favour with a public disposed to renounce the excessively dysfunctional model we currently have.

From a technological perspective, the constant advancements achieved in the various areas that have a bearing on digital communication can all contribute to enhance the future interface of the Digital Consumer Label, whether it be in terms of functionality or presentation. Smart phones catalyse a lot of these technological leaps at the moment and could offer a stimulating environment for the consumer label database to rapidly release its potential and acquire greater usability. In today's particularly effervescent context, even more convenient supports could soon interface with the product label database, such as *sixth sense technology* for instance where devices are created to help the physical world intuitively interact with the world of data (Mistry 2009). Rather than being disrupted by current advances, it seems the architecture presented here can greatly benefit from them.

A Not so *Ideal* Form of Communication

The digital phase of information is revealing other forms of communication. From a cognitive perspective, consumers, who are also fast becoming Internet users, become receptive to digital interfaces which multi-dimensionality can be very engaging and potentially more informative.

In order to achieve this more engaging communicative environment, it is assumed, that perfect communication is not a realistic pursuit. Rather, communication is thought as a constant negotiation to achieve meaning. Within

the digital product label architecture, this premise is delivered through the juxtaposition of two modes of thinking: values and reason.

- Contextualisation: The whole contextualising process is a tagging exercise where data becomes associated to values. This is the organising principle of the digital product label database. From there, the ethical referential can impart meaning by offering a basis for discussions to be held and interpretations to be constantly negotiated and refined. Also, by bringing the context of the life cycle close to the object being assessed, the label becomes an antidote to the compartmentalisation of knowledge that is often preventing a more wholesome picture from being formed and more wholesome meaning from being achieved.

- Verification: The context mechanism addresses values, the verification mechanism addresses reason. There are strong pedagogical undertones to this facet of the architecture. This is where the method to validate the information treated by the contextual frame is applied, and made explicit to users. This is also where the scientific method meets social values and can be distilled to the public. The process of verification is a complicated one. Informational propositions may be different by nature and, for that reason, may require a different approach. Furthermore, the state of verification may evolve through time. If a more lucid rapport with knowledge is to be nurtured, these two situational particularities

need to be energetically conveyed by the interface and effectively assimilated into users' experience.

- Participation: The participation mechanism creates the conditions for meaning to be negotiated in a balanced manner. Within this arrangement, the diversity of opinions and interests are clearly acknowledged allowing for *conflicts* to be accepted as a reality. From there, means can be provided to handle them in a more constructive manner.

- Positioning: The positioning mechanism registers personal values and allows constant adjustments to be made between global perspectives and personal circumstances. The control over values and the possibility offered to translate awareness into modes of action help negotiate these perpetual adjustments.

In this architecture, our rapport to information is acknowledged as fallible and we are equipped to adopt a more lucid posture by assimilating critical communicative skills. These communicative skills constantly weigh the expression of subjective values against a more objective process of verification.

With regard to this process of verification, some may argue that not all users want to understand how the data is verified, and that in order to make decisions, they would only need to know that the information has been properly verified. As a result, it would be sensible to accept the current practice of burying

this sort of material in order to minimise the possibilities of information overload. But this position seems untenable in today's digital environment where very resourceful options are available to information designers to make the verification data conveniently accessible. It is correct in a sense to assume that, most of the time, users may not want to know how the product has been validated. However, in the event when they do, driven by their interests, they ought to have easy access to this level of information and distribute their informed reactions with the rest of the community if they judge it to be useful. The diversity of interests will allow for a vast amount of information to be reviewed while the capacity to readily access the verification data becomes a very effective form of data *sousveillance*[4].

Furthermore, this journey into the deeper level of the database could translate into a rich pedagogical experience in at least two respects: (1) by imparting the methodological reasoning behind the verification process to users so they can develop an instinct for the sort of standards needed to deliver information quality, and (2) by giving an understanding of the arguments that serve to produce a particular assessment so that consumers' behaviours and decision making process can be profoundly enriched. Knowing the fact that High-Fructose Corn Syrup is unhealthy is different from understanding the reason *why*

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[4] "***Surveillance,*** from the French for "watching over," refers to the monitoring of people by some higher authority — the police, for instance. Now there's ***sousveillance,*** or "watching from below." It refers to the reverse tactic: the monitoring of authorities by informal networks of regular people, equipped with little more than cellphone cameras, video blogs and the desire to remain vigilant against the excesses of the powers that be."(Hoffman 2006)

it is unhealthy. In the first case, consumers are more likely to ignore the warning after a certain period of time. In the second case, a deeper understanding can profoundly inhibit the purchase of the product.

These two intellectual dispositions (i.e. understanding the requirements of the verification process and acquiring a deeper understanding of the arguments that define a particular information situation) are not overly complicated. They could seamlessly become critical reflexes among consumers through exposure to the digital label's interface and could readily transfer onto other information situations. They are also constituent parts of a well-educated citizenry and could help nurture a more mature lexicon for the public sphere. This setup would contrast with the more binary form of communication that characterises today's exchanges, and one can't help but wonder the possible impact the large-scale dissemination of these elementary rational abilities would have on society.

Part III – Sociological Considerations

This part of the dissertation is a reflection on the merits of the architecture developed in the previous section, this time, from a sociological perspective. The exercise consists essentially in validating the digital label as an information arrangement capable of responding to current societal demands. It should also determine the label underlying principles in order to guide further development. In chapter 6, a definition of quality is proposed which brings forward the notion of a public sphere where informational transactions concentrate on the ethical design of consumer goods through value negotiation. In chapter 7, the relevance of the architecture is examined from an economic perspective.

CHAPTER 6 – A DEFINITION OF INFORMATION QUALITY

Failure to assure quality of information is a major concern in the literature attentive to the revolution we now experience in terms of communication.

Andrew Keen (2007) offers a strong criticism of Web 2. He persuasively points out the issues with user-generated content culture and concludes professionalism is more suited than amateurism to guarantee quality. It follows that the mainstream media should be a point of reference and the source for culture.

Keen is certainly right to draw our attention on the role of the expert and of the establishment in warranting quality, but his strong reaction against the Internet and his view that the exploitation of its collaborative potential serves to debase culture may be unfounded. The Internet now provides an opportunity for experts, amateurs and users feedback to meet. It remains often difficult to situate the contribution of each of these groups, but understanding how collaborative logics can deliver their full potential is a worthy effort that can lead to the constitution of a rich information heritage. The democratisation of knowledge may not necessarily lead to a loss of quality, and a fated relativism in constant denial of rich histories and incapable of distinguishing between many and any. On the contrary, this new communication environment may help us achieve a more mature definition of quality.

Quality is a multidimensional concept and can be considered from various angles. It is in constant evolution and Keen's analysis only seem to reveal a partial conception of it, one that exempts itself from a socio historical context and ignores what may condition the evolution of quality and our perception of it. It may also needlessly antagonise two ideas of quality, one that pursues ideals of aesthetics reminiscent of a culturally influential Greek heritage, and one associated with a more utilitarian agenda where social goals have a greater ascendance. In addition, Keen's position seem to condone the failure on the part of the establishment, until now, to produce a definition of quality that can be shared and that can manifest itself in the most concrete aspects of public life.

Moreover, it is doubtful whether the tide can be reversed. We now have a technology that is radically redefining who owns information and how it is being transmitted. This technology is here to stay and the new production-diffusion paradigm it offers, forces us to consider what informational domain of public life deserve our collective attention, how values and expertise relate to each other in these domains to produce knowledge and how pedagogical aspects can be reconfigured to facilitate the circulation of knowledge. These interrogations are at the heart of a reflection on the concept of quality of information, there are no longer restricted by the limits of the printing model, and they have the potential to transform our societies. This is why the digital revolution causes such enthusiasm.

Finding the right informational arrangements that can translate these great aspirations into concrete applications, depends, it would appear, on our ability to produce a more complete and more nuanced definition of quality.

The areas of research dealing with *Information Quality* are still at the stage where criteria are being elicited and definitions suggested. Quality is, in some ways, subjective and attempting to retrace its various sources, set standards and measure it can be an arduous task.

By contrast with the large number of quantitative approaches catalogued in bibliographic reviews on this subject (e.g., Eppler and Wittig 2000; Knight and Burn 2005; Arazy and Kopak 2011) and without ignoring their merits, the approach suggested here appeals primarily to sociological references to help refine our perception of quality.

It suggests quality, in the case of widely used consumer products, has to do at some point, with being able to negotiate values. This negotiation leads to the improvement of consumer products and can be achieved by defining a public sphere of information that uses ethics as a frame of reference and a rational process of verification to manage data.

In this manner, the digital label becomes a platform where the critical spirit of the public sphere as envisaged perhaps by Jürgen Habermas (1991) can be revived. This critical public sphere was, according to the German philosopher and sociologist, quite vigorous in 18th century Europe but declined under the

pressure of a consumerist contemporary society. His theory of communicative action is an attempt to capture its essence so our modern societies can move away from a bureaucratic representational democracy to a more participative one. The digital label models an environment where ideal speech situations are created and critically minded citizens are equipped to engage in a rational deliberative process.

The focus on consumer products and the improvement of their design as an information situation to be treated is of major significance in this ethical public sphere. Consumer products are, to a large extent, the cornerstone of economic life and, in a sense, citizens' most common denominator. Designing a rich informational environment that can adjust the dynamics of this most influential realm of public life may naturally and positively impact other key facets of our public life, and also, of our private life. Emotionally, it offers a sensible incentive for a structured debate to take place, common grounds to be reached, interpretations to meet and refine themselves, and meaningful standards to be produced. Practically, it offers foundations for a common language of action to support the collective project of managing our resources. What we produce and how we produce it are fundamental aspects in the development of civilisation.

Chapter 7 - The Economic Perspective

The relevance of the information arrangement suggested in this study may also be examined from an economic point of view.

In the Wealth of Nations (1776), Adam Smith articulates the foundation of modern economic theory. In this landmark text, free market economies in the context of an industrialised revolution, are advanced as more productive and profitable to their societies. A key aspect of Smith's thesis is that, without any central planning body, millions of people motivated by self interest appear to seamlessly coordinate their activities in a way which is mutually beneficial to all of them... as if guided by an 'invisible hand'.

An example often cited by economists to illustrate the modern significance of this observation is provided by the libertarian economist Leonard Read, in a famous essay entitled "I, pencil" (1958) [5]. In this essay, the extraordinarily complex production process which leads to the creation of an object as mundane as a pencil is described in great detail and used to account for the powerful economic forces at work behind the formation of our material wealth. It is argued

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[5] The full title is "I, Pencil: My Family Tree as Told to Leonard E. Read". This essay is written in the first person from the point of view of a pencil. The pencil details the complexity of its own creation, listing its components (cedar, lacquer, graphite, ferrule, factice, pumice, wax, glue) and the numerous people involved, down to the sweeper in the factory and the lighthouse keeper guiding the shipment into port.

that not one individual or entity could comprehend the totality of know-how(s) necessary to fabricate this ordinary product and therefore not one individual or entity should attempt to master-mind such a complex production process. Rather these know-how(s) will naturally and "automatically, arrange themselves into creative and productive patterns in response to human necessity and demand".

The metaphor of the 'Invisible hand' has also come to underpin the idea that forces of competition and selfishness can create very good outcome for society. It has also, from a more radical standpoint, served to reject government intervention in all its forms. However, there may be a variety of situations where these forces might come together in ways which are not directed for the betterment of society and where profits based on self interest may not necessarily service social function. When the principles of market produce not better products, but ill-conceived 'toxic' products, or products whose fabrication or consumption has a negative impact on society, Smith's revered metaphor seems particularly fragile and no longer able to sustain a non-interventionist libertarian model of economy. Clearly, such model is unable to stimulate, in practice, logics of freedom, creativity or prosperity and social responsibility. The invisible hand appears to be missing the guidance, the *intervention*, of a conscientious mind.

A strong argument in the way of free market theories stems from the fact that economic actors need to be well informed. Unfortunately, today's markets are not characterised by a rich and mature informational environment.

In addition, if we decide quality of information is a constitutive principle with crucial regulatory virtues, we then need to determine the ingredients which could constitute this rich and mature information environment. There appear to be a lack of consensus on what can be regarded as 'relevant' information with which consumers can engage. But without this consensus, consumer's capacity to exercise fully their right of free choice appears limited.

The architecture proposed through the digital label is an attempt to actuate the conscientious mind by carefully considering the problematic that motivates economic reflection.

Economic reflection derives from the realisation that every society has to solve the joint problems of resource management and of coordination between those who produce and those who consume. And the remarkable self-organising properties of free market economies, as noted by Smith, do not exempt us from figuring out the answer to two questions: "What should be produced?" and "How it should be produced?"

Today, the composition of information does not easily accommodate these essential questions. The division of labour, which is an integral part of the Industrial Revolution, has allowed achieving tremendous progress in terms of productivity. But it has also led to the fragmentation of information, in ways which has restricted the promotion of truly creative and prosperous societies. A consumer may not be able or indeed may not require understanding the know-how(s) encompassed in the creation of the product he or she uses, nonetheless

he or she may need to know how the fabrication of the product she or he uses affect them and affect society. In addition, she or he needs to be able to assess the merits of products against a more wholesome value scale than the ones currently available.

The ethical driven contextual arrangement at the basis of the digital label provides a referential within which these basic economic informational requirements can be treated. .

The themed ethical evaluation of the extended life cycle provides an opportunity to appraise in greater depth the two fundamental questions of 'what should be produced?' and 'how it should be produced?' The more democratic collaborative arrangement chosen to situate the contribution of the various label's stakeholders offer the possibility to open to scrutiny the entire product life cycle and identify its critical elements in an open and principled manner. The rich verification interface fosters the development of valuable interpretive aptitudes to processing information. Finally, the positioning mechanism reduces possible tensions between global and local interests by giving users the possibility to formulate and actively negotiate individual interests with respect to collective values. The *Tragedy of the Commons* as described by Garrett Hardin (1968) need not be[6].

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[6] The tragedy of the commons is a metaphor that illustrates the dilemma arising from a situation in which every individual of a group, driven by the pursuit of personal gain, will over-exploit shared limited resources, even when it is clear that it is detrimental to all the members of the group in the long-term.

In a sense, the approach suggested in this study is very attentive to libertarian concerns of freedom, creativity and prosperity. The difference is that it does not assume that these notions are necessarily or solely served by forces of selfishness. As a matter of fact, Adam Smith, as a moral philosopher, also came to acknowledge another facet of human nature. This is what he says in the Theory of Moral Sentiment (1759).

> *How selfish soever man may be supposed, there are evidently some principles in his nature, which interest him in the fortunes of others, and render their happiness necessary to him, though he derives nothing from it, except the pleasure of seeing it. Of this kind is pity or compassion, the emotion we feel for the misery of others, when we either see it, or are made to conceive it in a very lively manner. That we often derive sorrow from the sorrows of others, is a matter of fact too obvious to require any instances to prove it; for this sentiment, like all the other original passions of human nature, is by no means confined to the virtuous or the humane, though they perhaps may feel it with the most exquisite sensibility. The greatest ruffian, the most hardened violator of the laws of society, is not altogether without it.*

How economic models will evolve is a key question in the digital age. Today, economic prosperity produces goods that make consumers dependent, and phenomena such as marketed misinformation, scheduled obsolescence are becoming acceptable, almost unavoidable. But digital communications demonstrate a potential to radically change the deficient systems we now rely upon to create economic activities. There are plenty of possibilities and models that need to be assessed according to their merits. Our public information system will need to have quality built into them to transform the digital potential into a reality.

FUTURE PROSPECTS

This research has demonstrated that a digital labelling system of the kind suggested here could engender a number of useful applications and be of great value to consumers, and beyond consumers, to the larger economic context that sustains their activity.

At this stage, the digital label appears conceptually capable to meet consumer needs and is ready to be implemented into a prototype.

Today's research environment is rapidly changing and new models capable of supporting the implementation phase are now available that challenge traditional academic and business practices. As a result, determining what the right conditions are to ensure that a project has the best opportunity to develop and deliver its potential becomes an essential component of any research proposal.

This project is clearly oriented towards the public domain and requires an environment that will not frustrate its most basic aspirations. Funding opportunities should be explored among public agencies. Partnerships with consumer associations and regulatory agencies would certainly benefit the developmental phase. Open source logic also appears a most suitable avenue to produce a working prototype within a couple of years. During this time, It is most probable that emergent technologies will continue to benefit the prototype.

This prototyping could focus on widely used consumer products such as food and rapidly move on to other strategic consumer products. It could also include key services. In today's context, the labelling of financial products for instance could reveal particularly useful as advocated by French et al. (2010), already mentioned in the Introduction.

In parallel with the development of the prototype, the reflection initiated in section three could be pursued in order to guide development from a sociological perspective. At this juncture, there are two key directions to explore. One is more theoretical and concerns the refinement of the concept of quality of information as suggested in this study while the other would consider the digital label architecture from a more economic mindset. The comparative review in the Result and Discussion section emphasised the descriptive character of the proposed architecture and how it could serve as a basis for further investigation. Both this fields of research (i.e. information quality and economic perspective) could use the four-tiered architecture presented here as a basis to record, analyse, compare, and discuss how the concept of information quality could evolve and what sorts of economic models could emerge from these new information arrangements.

There may be another stimulating angle of research for the label whereby the mapping of consumer values could be examined from the perspective of a semantic web. The digital product label allows for the expression and collection of global and individual values. This structured layer of information could perhaps be integrated to the development of future Internet architectures.

CONCLUSION

"The more elaborate our means of communication, the less we communicate" claimed the 18c British theologian and educator Joseph Priestley. Those who seek to explain the shortcomings of the digital revolution often use this quote as a prophetic statement. But is there really a case of reverse proportionality to be made here?

Technological advances create new possibilities and new situations that can deeply condition sociological developments, but this does not necessarily translate into a loss of meaning. It may be more fruitful to consider technologies as intrinsically neutral and engage with more fundamental questions on why and how to use them. This is precisely what this thesis is attempting to address.

In the first part of this study, the limitations of the printed format were clearly acknowledged in the case of consumer products. Product labels were shown not to offer a satisfactory level of information to consumers. It was also established, at this point, that a vast amount of information is now available online for consumers to satisfy their personal requirements, but that this complement of information was not sufficiently organised to form a rich and coherent informational environment.

In the second part of the study, the digital format provided a fertile conceptual environment for the elaboration of a stimulating consumer product

label that could address these deficits. Four mechanisms constitute this new label:

1. *Contextualisation:* where the information that relates to the entire product life cycle is contextualised according to an ethical frame of reference.

2. *Verification;* where information is treated according to an open process of verification that includes protocols and results and is presented through a more cognitively engaging interface.

3. *Participation*: where contextualised information and verification data can be transacted efficiently between the various label stakeholders (i.e. consumers, producers, experts and regulators) in order to produce a dynamic and informative global label.

4. *Position*: where consumers can register their position in terms of values and circumstances in order to personalise the information provided through the global label and identify courses of action more in line with their own preferences.

This four-tiered arrangement appears in theory capable of delivering a valid quality filter for the constitution of a more wholesome and mature public information system. A prototype would help confirm its practical relevance.

The third section of the thesis considered the elaboration of the digital consumer label from a sociological angle. The concept of quality of information

was briefly reviewed as well as the relationship of this type of information system with economic theory. Both these vantage points could help validate further developments and better identify the characteristics the architecture ought to emphasise if it is to increase its pertinence as a public information system.

At present, the architecture assumes a strong pedagogical agenda that focuses on the development of users' potential. New technological possibilities encourage the participative management of public information systems. This discernible and demanding repositioning of information means citizens need tools to better assume their newly acquired responsibilities and form a more subtle and efficient bond with information.

In today's digital context where information has become collaboration, it seems the array of critical aptitudes necessary to develop this bond, must be acquired instantaneously, must generate awareness, deliberation, free consent and social responsibility uniformly both at the local and global levels. A distributed awareness of our limitations and degrees of freedom are consequently as vital as the acquisition of a common language to nurture a reflex towards critical thinking, and an almost 'compulsive' taste for informational quality.

The expression of values and evaluation of the state of information are the two key conceptual references that enable the system to engage with these aspirations. Together, they structure our rapport with information and provide a

more nuanced and less binary form of communication for the *virtual* public sphere.

In the case of product label, the rigidity of the printing model clearly engendered an unwarranted simplification that crystallised the compartmentalisation of knowledge and did not leave much space for realistic expectations to be formed on the part of consumers. By comparison, the digital consumer label provides a platform where informational complexity can be handled rather than concealed, and a more lucid posture towards information can be negotiated. This is done by making visible the dimension where values operate and by revealing to users the process of verification rather than 'subjecting' them to its un-scrutinised product.

There are clear advantages to this communicative strategy, amongst these, the possibility for consumers to foster an invigorating appreciation of diversity, subjectivity and objectivity. More specifically, the capacity to distinguish between what is clearly known, what is questionable, and what is unknown offers an incomparable interpretive standpoint from where deeper forms of awareness promote better courses of action. Within this more perceptive cognitive environment, inconsistencies are more likely to be identified and removed from the common information heritage. This set up generates as well, a more coherent space for the design of truly ingenious consumer goods. Last but not least, this informational arrangement produces more balanced conditions for the treatment of conflicts and attenuates the possibilities of information manipulation.

The relevance of this architectural approach seems applicable beyond the informational situations presented in this study. For instance, it may be worth considering in what manner both these communicative concepts could be integrated into the elaboration of a semantic web. The mapping of consumer values and the uncovering of the verification process appear to be constitutive attributes of a web of data. They could in time weave the collective ethical fabric of the Internet and discourage the tendency there is today to use artificial capabilities in places where human responsibilities are expected to occur.

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APPENDIX A

This appendix contains the URLs that have been consulted during the online searches conducted for each case study and whose overall summary is provided in the 'Online Search' section of the 'Analysis'. These sites were initially consulted between May and September 2011. They were accessed again in December 2012 to ensure the links were still live.

CASE STUDY 1 – FAT SPREAD

- http://www.guardian.co.uk/environment/2010/jan/23/margarine-butter-health-wars
- http://Webcache.googleusercontent.com/search?q=cache:L2ti2MmYAacJ:http://www.second-opinions.co.uk/fats_and_cancer.html+hydrogenated+oil+flora&hl=en&ct=clnk
- http://www.drcranton.com/nutrition/margarin.htm
- http://www.independent.co.uk/news/new-margarine-cuts-heart-attack-risk-1083776.html
- http://www.eatwell.gov.uk/asksam/healthydiet/fssq/-A218110
- http://www.tfx.org.uk/page11.html
- http://www.food.gov.uk/scotland/aboutus_scotland/contactus/

CASE STUDY 2 – MILK

- http://www.organicandfairplus.com/2001/08/01/organic-articles-labelling-matters/
- http://www.aboutorganics.co.uk/organic_information/organic_accreditation.htm

- http://www.soilassociation.org/whatisorganic/organicfood/foodlabelling
- http://www.quackwatch.com/01QuackeryRelatedTopics/organic.htm
- http://hubpages.com/hub/Organic-Milk--Is-It-Worth-Your-Money

CASE STUDY 3 – COFFEE

- en.wikipedia.org/wiki/Fair_trade_coffee
- http://www.Fairtrade.net/faqs.html
- http://www.bbc.co.uk/bloom/guides/Fairtrade.shtml
- http://news.bbc.co.uk/1/hi/magazine/6426417.stm
- http://en.wikipedia.org/wiki/Fair_trade_debate

CASE STUDY 4 – SOCKS

- http://www.newscientist.com/article/dn13602-smelly-sock-treatment-leaks-silver-nanoparticles.html
- http://www.shoebuy.com/diabetic-care-microfiber-w-silver-technology-crew/208782
- http://www.tdshealthcare.co.uk/
- http://schneiderinvestigates.wordpress.com/2009/06/11/health-risks-from-silver-nanoparticles-a-growing-threat-to-consumers-and-workers/
- http://pubs.acs.org/cen/news/87/i40/8740notw6.html

CASE STUDY 5 – WOOD

Tanalised

- http://wiki.answers.com/Q/What_is_'tanalised'_wood
- http://www.uow.edu.au/~sharonb/CCAtimber/
- http://resources.pihomebuild.com/sites/478/docs/2cop_tan_e_1.pdf
- http://en.wikipedia.org/wiki/Chromated_copper_arsenate
- http://www.delston.co.uk/tanalised.htm

FSC

- http://www.fsc.org/fsc-rules.html
- http://www.fsc-watch.org/
- http://www.fsc-watch.org/archives/2011/02/04/_Latvia_s_pulp_ficti

APPENDIX B

This appendix contains the emails exchanged between Unilever, the company that produces the fat spray used in the first case study of the Analysis section, and the author.

an email was sent to Flora at keepintouchwithflora@unileverconsumerlink.co.uk on 20 July 2010 after contacting their customer care line which number could be found on the label. Customer care line advised that a reply would be given within 48 hours for basic questions and up to a week for more technical questions as they would need to be forwarded to a more competent service. The response was sent more than 5 days later.

Email from: ni lo <nihalbilgi@googlemail.com>

To: keepintouchwithflora@unileverconsumerlink.co.uk

Date: 20 July 2010 17:57

Subject: Flora Heart Age

Dear Sir, Madam,

Following a recent article - "I can't believe it's not ... healthy!" published online by the Guardian on Saturday 23 January 2010 – concerning the use of hydrogenated oils in some widely used food product like margarine or vegetable fat spread, I have decided to research the subject and came across some interesting facts. This raised a few concerns on my part and I decided to contact your customer helpline on 13 July 2010 and was attributed the following query reference number: 1005829. On that day, I received a few answers from two different customer care advisers - which correspond to Q1, Q2 and Q4 below.

However, these answers, in turn, raised more questions and it was decided then that writing an email may be a more suitable form of communication.

Q1 - Does Flora Heart Age Original (the product I buy on a regular basis) contain any hydrogenated oils?

A1 – No

Q2 - Does Flora/Unilever currently sell products which contain hydrogenated oils?

A2 – Yes Elmlea - one cream which production will be phased out in the next three months

Q3 - In 2006, Felicity Lawrence, the author of the article mentioned above, met Unilever's director of external affairs Anne Heughan. On that occasion, Mrs Heughan declared "As a responsible manufacturer we can only go with the evidence (available) at the time. When Walter Willett's evidence in 1993 indicated that trans fatty acids were as bad as saturated fats we felt that the weight of evidence had moved and we set about removing them. It took about two years." Why in this case does Unilever, in 2010, still sell a product (Elmlea) which contains Hydrogenated fats?

Q4 – If this process is no longer used to produce Flora Heart Age fat spread, then what alternative process is used to solidify the polyunsaturated oil?

A4 - Interesterification

Q5 - A recent independent study suggests that the health implications of the use of Interesterification in the production of fat spread, much like in the early days of hydrogenated fats, are not yet known. Many questions remain unanswered. In the light of this comment, are you able to justify the use of interesterification as an alternative process to hydrogenation?

The study in question can be found at the address below

http://www.nutrociencia.com.br/upload_files/artigos_download/Trans%20Fats%20in%20America.pdf

Q6 – Unilever has worked closely with the medical profession for the last few decades to develop products which respond to public health concerns. The well referenced literature based on independent research I have come across on the Internet highlights issues regarding the multiple processes used to extract oils from seeds. In addition, the type of seeds selected and the amount of pesticide employed to grow these seeds could also have a detrimental effect on health. Have these concerns been clearly assessed before considering associating health claims to Flora Heart Age?

Q7 - More specifically, does Unilever have a formalised process to take into account evidence based on independent research that may contradict research being carried out by the partners the company has in the scientific community?

I realise these questions are difficult, I would appreciate, however, if you could answer them as clearly and unambiguously as possible.

Regards,

Nihal

Below is the response sent by the company.

Email from: keepintouchwithflora@unileverconsumerlink.co.uk

To: nihalbilgi@googlemail.com

Date: 26 August 2010 13:56

Subject: Flora query CaseID#1011412#

Unilever Careline

Dear Nihal,

I am sorry for the delay in responding to your email. Below are the answers to your proposed questions:

Q1 - Does Flora Heart Age Original (the product I buy on a regular basis) contain any hydrogenated oils?

A1 - No

Q2 - Does Flora/Unilever currently sell products which contain hydrogenated oils?

A2 - Yes (e.g.) Elmlea - one cream which production will be phased out in the next three months

Q3 - In 2006, Felicity Lawrence, the author of the article mentioned above, met Unilever's director of external affairs Anne Heughan. On that occasion, Mrs Heughan declared "As a responsible manufacturer we can only go with the evidence (available) at the time. When Walter Willett's evidence in 1993 indicated that trans fatty acids were as bad as saturated fats we felt that the weight of evidence had moved and we set about removing them. It took about two years." Why in this case does Unilever, in 2010, still sell a product (Elmlea) which contains Hydrogenated fats?

A3- Please note that the formulation has changed. Elmlea products are made with a blend of buttermilk (or whey in the case of Elmlea Squirty) and vegetable oils. The vegetable oils include hydrogenated vegetable oils to ensure the consistency of the products closely resembles that of dairy cream. The hydrogenated vegetable oils used, however, illustrate that such vegetable oils are not always major sources of trans fats. If hydrogenated, as are the ones used in Elmlea products, they contribute mainly saturated fats to the diet, not trans fatty acids. Elmlea is a healthier alternative to cream and the level of trans fats in Elmlea is half that of dairy cream.

Q4 - If this process is no longer used to produce Flora Heart Age fat spread, then what alternative process is used to solidify the polyunsaturated oil?

A4 – fat re-arrangement (also called interesterification)

Q5 - A recent independent study suggests that the health implications of the use of Interesterification in the production of fat spread, much like in the early days of hydrogenated fats, are not yet known. Many questions remain unanswered. In the light of this comment, are you able to justify the use of interesterification as an alternative process to hydrogenation? The study in question can be found at the address below:

http://www.nutrociencia.com.br/upload_files/artigos_download/Trans%20Fats%20in%20America.pdf>

A5- Health experts recommend a reduction in the intake of saturated fat and trans fat to decrease the risk of cardiovascular disease. Unilever is committed to continuous improvement of the nutritional value of our spreads, aiming at products that contain higher levels of unsaturated fats, lower levels of saturated

fat and are virtually free of trans. Companies such as Unilever used fat re-arrangement to replace partial hydrogenation of vegetable oils to eliminate trans fat in our products. This provides a clear nutritional benefit to the consumer as well as allowing us to develop products of high quality.

In response to nutritional aspects, in the last two decades several well-controlled human studies have investigated the effect of fat rearrangement, while keeping the dietary fatty acid composition constant. These studies found no or only very little, effect on blood lipids and lipoproteins.

Overall fat re-arrangement has been used for decades to modify edible fats and oils and Unilever have aimed to help consumers reduce intake of saturated fat, hydrogenated vegetable oils and trans fats for their long term health benefit.

Q6 - Unilever has worked closely with the medical profession for the last few decades to develop products which respond to public health concerns. The well referenced literature based on independent research

I have come across on the Internet highlights issues regarding the multiple processes used to extract oils from seeds. In addition, the type of seeds selected and the amount of pesticide employed to grow these seeds could also have a detrimental effect on health. Have these concerns been clearly assessed before considering associating health claims to Flora Heart Age?

A6 - Unilever adheres to the highest standards regarding the quality of our oils and fats for consumption. This quality is monitored on a regular basis together with the suppliers of all our oils and fats. This high oil quality is obtained by a series of purification steps that aim to render the product acceptable for consumers. This comprises removal of both components that occur naturally in the oil (e.g. free fatty acids, colours and off-flavours) as well as remainders from seed cultivation, storage and extraction (e.g. residual solvents or pesticides). Moreover, the use of such seed processing materials, is strictly regulated by European legislation that is based on extensive safety assessments.

Q7 - More specifically, does Unilever have a formalised process to take into account evidence based on independent research that may contradict research being carried out by the partners the company has in the scientific community?

A7 - A team of scientists at Unilever continually keep abreast of all research and not just research that is carried out internally. Based on all the available

information in the field formal claims are assessed. If the science is not strong enough to substantiate a claim then it is not approved.

I hope this information is useful and I hope this has answered any questions you may have encountered.

Kind regards,

Nilla Hjort

Nutritionist

Unilever Careline

APPENDIX C

This appendix contains the query I sent to Sanitized, the company that provide the silver technology during the manufacturing process, and the reply I received.

The query was sent on 20 July 2010 using a contact form on their website. The reply came the same day

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Hi,

I would have a few questions regarding your FAQ statements.

(1)Although, having new technologies appraised independently is good practice, existing standards have at times in the past revealed insufficient to assess the long term impacts or cumulative effects on the environment of new technologies. Are the "stringent quality tests" and standards you are referring to able to take these aspects into account for silver particles in the size range considered?

(2) You highlight the fact that " Sanitized® Silver has been designed to durably bond on the fibre. Therefore, Sanitized® Silver does not leak into the waste water." However, these particles are necessarily released into the environment when they are worn (as opposed to just being washed) and once they reach the end of their life cycle. The tests you carried out may only have considered repeated washings, but what happens under these other circumstances?

Thanks in advance for your reply.

Regards,

Nihal

---

from:	thomas.wallenhorst@sanitized.com
to:	nihalbilgi@gmail.com (Yes, this is you.) Learn more
cc:	Urs.Stalder@sanitized.com, Kathrin.Mueller@sanitized.com, Urs.Zihlmann@sanitized.com
date:	20 July 2010 10:42
subject:	Re: Fw: Contact website
mailed-by:	sanitized.com

Dear Nihal,

thank you very much for your interest in Sanitized® products and your questions concerning the environmental aspects.

As responsible specialists for antimicrobial finishings with a broad spectrum of applications, we attach great importance to the safety of all Sanitized® products for man and environment.

Concerning your questions, we always apply the latest scientific information and state of the art technologies to ensure the safety of our products, this includes also environmental aspects. We take the whole life cycle of the product in consideration and evaluate the risk potential of the product in every life phase. We can assure you that our silver products have a negligible impact to the environment and there is no reason of concern for the possibly released silver.

We hope we have answered your question to your satisfaction.

Best regards

T. Wallenhorst

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